Click to proceed to Table of Contents

Flood Hazard Mitigation Plan

City of Conway
South Carolina

February 16, 2000

French & Associates, Ltd.
Park Forest, Illinois

Flood Hazard Mitigation Plan

Executive Summary

1. Introduction

In September 1999, Hurricane Floyd caused extensive flooding in the City of Conway. In response, the City Council created a Mitigatoin Planning Committee and charged it with reviewing all options that can prevent or reduce flood losses in the future. The Committee prepared an *Interim Report* that recommended three activities that should be implemented as soon as possible:

1. Voluntary floodproofing for non-substantially damaged properties
2. Acquisition of substantially damaged buildings
3. Mitigation for flooded City facilities

The *Interim Report* was adopted by the City Council on November 8, 1999. The Committee then prepared *Flood Hazard Mitigation Plan* which builds on and complements the *Interim Report* and covers the full range of short- and long-term mitigation strategies and measures. The Plan itself is 90 pages in 10 chapters. This *Executive Summary* only includes the major findings and recommendations.

2. The Flood Hazard

Conway is subject to overbank flooding from Crabtree Swamp, Kingston Lake Swamp and the Waccamaw River and local drainage problems. This *Plan* addresses both types of problems.

Flooding following Hurricane Floyd resulted in damage to 150+ properties and disruption to all residents, businesses and travelers. While the smallest of the three waterways, Crabtree Swamp has been the source of the most flood problems.

Conway's floodplains provide natural and beneficial functions and improve the recreational and economic development opportunities for City residents. This *Plan* calls on preserving and capitalizing on these benefits.

Development trends will likely increase flood losses. Only enlightened ownership, public ownership or new regulatory standards will curb the increase in flooding problems that will result from continued development. This *Plan* recommends measures to protect new development from increased damage expected from future flooding.

3. Goals and Objectives

Given Conway's flood hazard, natural floodplain functions and development trends as well as the recent experiences after Hurricane Floyd, three general goals are identified for the City's flood hazard mitigation effort.

Goal 1. Properties affected by the 1999 flood will be protected from damage from future floods.

Goal 2. New development and redevelopment will not suffer flood damage and will not increase the flood hazard.

Goal 3. The City's flood hazard mitigation efforts will support and be supported by residents, other programs and other agencies.

Each goal has three to five objectives that specify how the goal should be reached. These goals and objectives form the basis for the recommendations at the end of Chapters 4 - 9 and the action items in Chapter 10.

4. Flood Control

This is the first of six chapters on flood hazard mitigation strategies. After a general discussion of each measure, there is a short section on "Implementation in Conway." At the end of each chapter, the findings are discussed in a "Conclusions" section which is followed by a list of recommendations.

Structural flood control projects are used to prevent floodwaters from reaching properties. These measures are "structural" because they involve construction of man-made structures to control water flows. Two things most flood control projects have in common are that they are very expensive and they may affect other communities. Accordingly, most communities look to state or federal agencies to help them design and fund flood control projects.

Two federal agencies are the most active in flood control projects. The U.S. Department of Agriculture's Natural Resources Conservation Service has jurisdiction over smaller streams, such as Crabtree and Kingston Lake Swamps. The U.S. Army Corps of Engineers is the federal agency for flood projects in larger watersheds, i.e., the Waccamaw River.

The Committee looked at five types of flood control measures:

4.1 Reservoirs/impoundments
4.2 Levees/floodwalls
4.3 Diversions
4.4 Channel modifications
4.5 Channel and basin maintenance

The Committee concluded that a reservoir may be an appropriate flood control measure for Crabtree Swamp and one or more reservoirs or a diversion may be appropriate for the Waccamaw River. However, such projects would need careful study to:

- Ensure that they would actually reduce flooding
- Ensure that the benefits exceeded the costs of construction and maintenance
- Assess their environmental impacts
- Identify source(s) of funding

The last time the City reviewed its drainage needs was in 1979. Most of the projects recommended at that time have been constructed. A channel maintenance program will reduce overbank flooding from smaller, more frequent storms and will improve the appearance of the ditches and waterways.

Currently channel and drainage improvements and maintenance are the responsibility of the Department of Public Works and the Crabtree Swamp Watershed Conservation District. Both agencies have funding limitations. An alternative funding source is needed.

5. Preventive Measures

This chapter reviews measures that are designed to keep flood and drainage problems from occurring or getting worse. Preventive measures include:

5.1 Floodplain mapping
5.2 Comprehensive planning
5.3 Zoning
5.4 Floodplain open space preservation
5.5 Building construction regulations
5.6 Regulation of other facilities
5.7 Stormwater management
5.8 Development incentives

The base floodplain map for the City, the Flood Insurance Rate Map, was found to underestimate the true hazard presented by the base flood. Buildings constructed according to the minimum FEMA standard would not be protected from a recurrence of the 1928 or 1999 floods. Further, The boundaries on the FIRM inaccurately show the properties affected by the base flood. As a result, many property owners were unaware of the true hazard and many were not told to purchase flood insurance.

The City's and County's comprehensive plans do not address flooding beyond the minimum mapping and regulatory criteria of the National Flood Insurance Program. The County's plan recognizes stormwater management and natural resource protection needs and goals and recommends more specific actions to meet them. Both plans support several of the conclusions, recommendations and action items presented in this *Flood Hazard Mitigation Plan*.

Much of the floodplain is currently vacant. However, current ownership, the future land use plan and the zoning ordinance will do little to preserve these lands as open space. Building, subdivision, stormwater and other development regulations may or may not have clear and appropriate flood protection standards. Other than in the Waccamaw Riverfront District, the City's development incentives have not been used to encourage better floodplain design or construction practices.

6. Property Protection

Property protection measures are used to modify buildings or other facilities subject to flood damage rather than to keep floodwaters away. Often they are implemented by (or cost-shared with) property owners. There are a variety of flood protection measures that can be implemented to protect individual buildings from flooding: They include

6.1 Relocation and acquisition
6.2 Building elevation
6.3 Floodproofing
6.4 Lifeline protection
6.5 Flood insurance

The Plan concludes:

- Given the available funding, acquisition is most appropriate for buildings that were substantially damaged.
- Elevation is appropriate for buildings on crawlspaces. Financial assistance is available from several disaster assistance programs.
- Wet floodproofing is appropriate for buildings on crawlspaces.
- Barriers and dry floodproofing are for buildings on slab subject to shallow flooding.
- Two lifelines, the City Shop access road and the sewer lift and pumpt stations, would benefit from property protection measures

There should be more buildings with flood insurance coverage, although this may change after more people are made aware of the benefits of insurance and/or may be required to carry it as a condition of disaster assistance.

Many property protection measures can be installed by the owner or by a contractor at relatively little cost to the owner. There are a variety of ways the City can assist property owners implement protection measures, ranging from information to helping fund the design and construction.

7. Natural Resource Protection

Preserving or restoring natural areas or the natural functions of floodplain and watershed areas produce flood loss reduction benefits as well as improve water quality and habitats. These activities are usually implemented by parks, recreation, or conservation agencies or organizations. In addition to the four measures listed here, other measures, such as zoning and preservation of open space can also protect natural resources.

7.1 Wetland protection
7.2 Erosion and sediment control
7.3 Best management practices
7.4 Dumping regulations

Much of Conway's watershed is comprised of wetlands. Protecting these areas and preserving them as open space can help reduce flood losses. Conway has some regulations for protecting natural resources and water quality, but their effectiveness is limited to development within the corporate limits.

Development regulations should promote and reward developments that protect natural areas. The City should incorporate preserving natural areas in its work to preserve open space and should utilize interest in and programs that protect natural areas to support reservation of floodprone areas for a greenway or corridor.

8. Emergency Management

Emergency management measures protect people during and after a flood. The three distinct flood-related emergency management measures are reviewed in chronological order:

8.1 Flood threat recognition
8.2 Flood response
8.3 Post-disaster recovery and mitigation

An effective flood warning and response program relies on river gages to alert emergency managers to the impending threat. Such data are made available by flood stage and time predictions for the Waccamaw River at the Conway gage. However, to be useful, the gage stages need to be related to mean sea level, not the arbitrary river stages currently used.

Conway and Horry County successfully responded to recent floods. Shortcomings in the current response system should be identified and corrected during preparation of the after action report. An after action review is scheduled for early in the year 2000.

9. Public Information

Public information activities advise property owners, potential property owners and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of floodplains. They are usually implemented by a public information office. Public information measures can include:

9.1 Map information
9.2 Outreach projects
9.3 Real estate disclosure
9.4 Library
9.5 Technical assistance
9.6 Educational programs

There are many ways that public information programs can be used so that people and businesses will be more aware of the hazards they face and how they can protect themselves. Some of the public information activities are best done on a regional or county level, such as real estate disclosure and developing school curricula. Some of the public information activities can be prepared and implemented by the City and be tailored to meet local needs.

The City should implement and publicize the services that will inform and assist property owners who want to protect themselves from flooding. Meetings with selected groups, including schools and teachers, should be held so their members will become familiar with flooding, flood protection measures, natural floodplain and wetland functions, and City services.

10. Action Plan

The culmination of the *Flood Hazard Mitigation Plan* is the last chapter, the Action Plan. It has 21 action items to be implemented by 10 different City offices. They are listed on the next page

A plan is worthless if there is no instrument for ensuring that it is carried out. Accordingly, a Mitigation Committee is recommended to monitor the implementation of the *Plan*, for reporting to the City Council on its progress and to recommend revisions to this *Plan* as needed.

Flood Hazard Mitigation Plan Action Items

City Council

1. Adopt the *Flood Hazard Mitigation Plan.*
2. Create the Mitigation Committee and appoint its members.

Mitigation Committee

3. Monitor implementation of the Action Plan; report progress to the City Council.
4. Review the costs and benefits of preparing a drainage system capital improvements plan and/or joining the County's stormwater utility program.
5. Review ways to encourage residents to implement property protection measures
6. Meet with appropriate organizations and agencies to further coordination, cooperation and implementation of projects dependant on people outside Conway's City government.

City Administrator

7. Apply to the Community Rating System to reduce flood insurance premiums.
8. Help improve and formalize the County's flood warning, response and mitigation efforts.

Grants/Special Projects Coordinator

9. Submit the requests for a review of flood control alternatives on Crabtree Swamp and the Waccamaw River to the Natural Resources Conservation Service and the U.S. Army Corps of Engineers, respectively.
10. Submit the applications for funding for the acquisition of the substantially damaged buildings and floodproofing the sewer lift and pump stations.

Director of Planning

11. Prepare an open space/greenway concept plan for the vacant floodplain areas. The concept plan would identify a likely corridor for a trail and appropriate implementation methods, including acquisition, sources of funding, donation and regulatory approaches.
12. Conduct a review of the land use plan, zoning ordinance, subdivision and stormwater management regulations to identify changes that would make them more effective in preventing flood and stormwater problems and preserving natural areas.

Building Official

13. Review the floodplain regulation ordinance to make it clearer and easier to enforce.
14. Formalize and publicize providing map and hazard data and flood protection advice.

Director of Public Works

15. Prepare formal procedures for a drainage system maintenance program.

Public Information Officer

16. Develop and publish a periodic newsletter for floodplain residents.
17. Draft and publish a homeowner's flood protection manual.

City Engineer

18. Prepare a profile of the 1999 flood crest elevations and a regulatory floodplain map.
19. Report on the costs, benefits and impacts of raising the access road to the City Shops.

Department of Natural Resources

20. Review the current Flood Insurance Rate Map and request a restudy as needed.
21. Get the reported stages for all river gages converted to elevations above mean sea level.

Flood Hazard Mitigation Plan

City of Conway

Acknowledgments

This Flood Hazard Mitigation Plan was prepared under the guidance of the City of Conway's Mitigation Planning Committee. The members of the Committee are noted on page 1 - 4.

This *Plan* was funded in part with a Flood Mitigation Assistance Grant from the South Carolina Department of Natural Resources, Flood Mitigation Office.

The technical support provided by South Carolina Department of Natural Resources, the Federal Emergency Management Agency, the Horry County Division of Emergency Preparedness and the staff of the City of Conway is appreciated. Assistance was also provided by the agencies listed on page 1 - 7.

This *Plan* was prepared by:

French & Associates, Ltd.
153 Nanti Street
Park Forest, Illinois
708/747-5273
FrenchAsoc@aol.com

French Wetmore, Project Manager
Susan Josheff, Engineer
With support from ECO Planning, Inc., Santa Fe, New Mexico

Chapter 1. Introduction

1.1. Background

Hurricane Floyd: In September 1999, Hurricane Floyd caused widespread wind and flood damage along South Carolina's coastal counties. Horry County was the hardest hit. The City of Conway escaped much of the wind damage, but was subject to three successive and different types of flooding:

1. During the storm, the runoff from the heavy rainfall gathered in low spots and overloaded smaller ditches, causing shallow flooding throughout the City.

2. Within 24 hours of the storm, the local runoff caused Crabtree Swamp to flood.

3. Over the next three weeks, the Waccamaw River slowly rose and receded, flooding its floodplain and backing water up into Crabtree Swamp's floodplain for a second time.

The floods reached near record heights and caused extensive damage and dislocation. Several businesses were affected and over 100 families had to leave their homes. The County was declared a disaster area by the President on September 15. However, flood waters kept rising and did not crest on the Waccamaw until September 27. It took two more weeks for the Waccamaw and Crabtree to get back within their banks.

The resulting damage was surprising. While fewer than predicted properties were affected, the water was in many homes for a long period of time. This, coupled with the pollution and animal waste in the water, resulted in significant damage to those buildings that were flooded. Damage to contents and utilities was also extensive.

Conway's response: City staff responded to the disaster with a major flood fighting effort. With help from the County, the State and the U.S. Army Corps of Engineers, thousands of sandbags were placed around endangered sewer lift stations. Many blocks were evacuated and National Guardsmen were posted to control access.

Because the Waccamaw River flood rose and fell so slowly, City staff had a chance to assess the situation and prepare for recovery and reconstruction. On September 27, before the flood started receding, the Conway City Council passed a resolution that set four policies:

1. Keep the City in good standing in the National Flood Insurance Program to ensure that all residents can obtain financial assistance and flood insurance to protect their properties from flood damage;

2. Not allow any reconstruction or reoccupation of flooded buildings or homes until the City Building Official or his duly authorized representative has inspected the site and issued a building permit.

3. Carefully develop a mitigation plan for the affected area after a review of all options (including flood control, reconstruction, elevation, floodproofing and relocation) based on building conditions, the desires of the property owners, and funding sources that are available to assist the property owners; and

4. Assist residents with information on relocation and other flood protection measures and help them obtain financial assistance.

Polices 1, 2 and 4 were pursued vigorously by the City with help from many other agencies. Several handouts and other explanatory materials were prepared and the public was kept appraised of the reconstruction requirements, financial assistance, ways to protect themselves from future flood damage, and what the City was doing.

1.2. Purpose

This document is the mitigation plan referenced in policy 3 of the Council's resolution. It provides guidance and recommendations on how the City of Conway can mitigate flood losses in the future.

"Mitigation:" It is important to define "mitigation." The Federal Emergency Management Agency (FEMA) defines mitigation as "sustained action taken to reduce or eliminate long-term risk to people and their property from hazards and their effects." Mitigation does not mean controlling or stopping flooding. It means doing all that can be done to minimize the impacts of flooding.

There are a variety of mitigation strategies and measures. Some will work while others won't, depending on the hazard and the resources available to implement the measures. This *Plan* uses six strategies as a "checklist" to ensure that all possible measures are considered.

Mitigation Strategies

- **T** Flood Control
- **T** Preventive Measures
- **T** Property Protection
- **T** Natural Resource Protection
- **T** Emergency Management
- **T** Public Information

Determining what mitigation strategies and measures are best for an area is done through a planning process. During this process, the various hazards are inventoried, the full range of possible measures are reviewed, and the most appropriate and affordable ones are recommended for implementation.

In sum, mitigation planning is a careful, systematic review of what is possible and what is appropriate for a community. It is the opposite of making quick decisions on dealing with a flood problem or putting all of a community's hopes into one single project.

Post-flood planning: The time following a flood offers a special opportunity for mitigation planning. Certain measures, such as floodproofing, can be incorporated into buildings while they are being repaired. In some cases, buildings are so badly damaged that it makes economic sense to remove them from the path of flooding.

Accordingly, the City moved quickly to identify those measures that should be implemented using available disaster assistance programs and before people rebuild and "return to normal." This initial planning effort focused on the short-term concerns of reconstruction and redevelopment of the flooded area. Four factors guided this effort:

- The flood hazard
- The condition of the flooded properties
- The desires of the property owners
- Funding sources that can assist the property owners

These factors are reviewed in sections 2 - 5 of *Flood Hazard Mitigation Plan – Interim Report*, which was adopted by the City Council on November 8, 1999. It had three major recommendations that needed to be implemented during flood recovery:

1. Voluntary floodproofing for non-substantially damaged properties
2. Acquisition of substantially damaged buildings
3. Mitigation for flooded City facilities

This *Plan*: This *Plan* reviews the full range of short- and long-term mitigation strategies and measures. It builds on and complements the *Interim Report:*

- Chapter 2 reviews the technical aspects of the flood hazard faced by Conway.

- Chapter 3 identifies the goals and objectives recommended for the City's mitigation program.

- Chapters 4 - 9 address the six mitigation strategies and their measures, including those that can be implemented quickly and those that take more time to plan and develop. At the end of each chapter is a short section on conclusions and general recommendations for the City.

- Chapter 10 wraps it all up with specific action items that are recommended for implementation.

1.3. Methodology

Mitigation Planning Committee: The September 27 Resolution created a Mitigation Planning Committee. It also authorized an application for a mitigation planning grant from the state Department of Natural Resources and a planning contract with French & Associates, Ltd.

The Committee was charged to:

1. Collect data on building conditions, the desires of the property owners, and funding sources for reconstruction and redevelopment in the flooded area;

2. Recommend reconstruction and redevelopment policies and procedures to be followed by the City;

3. Identify particularly hard hit areas that could be designated as target areas appropriate for acquisition, clearance and conversion to open space;

4. Prepare a post-flood hazard mitigation plan for the City that designates target areas and recommends mitigation measures appropriate for the flood hazard facing the City; and

5. Keep the public informed of its deliberations and recommendations.

The members were appointed in the resolution. At its first meeting, the members elected their own chair and vice chair. Most of the Committee members had flooded homes, but they took time out from their own recovery efforts to work on this *Plan*. Meetings were held on October 4, 14 and 17 and December 5. Committee members also attended the public meetings on October 5 and 16. A subcommittee on the ordinance revisions met on October 7.

Mitigation Planning Committee

- Bill Graham, chair, floodplain resident
- John Griggs, vice-chair, floodplain resident
- A. M. (Mack) Floyd, floodplain resident
- Russell Faulk, floodplain resident
- James Goldfinch, floodplain resident
- Vivian Chestnut, Council member and floodplain resident
- Alys Lawson, Council member and floodplain resident
- Jason Collins, Director of Planning
- Ralph Bussey, Building Official and floodplain resident
- Jerry Barnhill, Director of Public Works
- Tabby Shelton, Grant/Special Projects Coordinator
- Linda Vereen, Assistant City Administrator, Public Information Officer, floodplain resident

Mitigation planning process: The Planning Committee set the directions and policies for this planning effort. City staff, particularly the Building Department, the Public Information Officer and the Grants/Special Projects Coordinator, implemented those policies. The building inspection effort was greatly aided by guidance from FEMA and staff from a dozen other South Carolina building departments.

The team of French & Associates did the legwork of data collection, research, analysis and draft findings. This team also drafted public information materials, handouts, the *Interim Report* and this *Flood Hazard Mitigation Plan*.

Public input: Two public meetings have been held. On Tuesday evening, October 5, the City Council chambers were packed with 100+ people. The Committee Chair and the consultant walked through the regulatory requirements and the planning process. Then questions were answered for approximately an hour more. After the meeting adjourned, individuals were able to talk one-on-one with the consultants and Committee members.

The second meeting was held on Saturday morning, October 16, at an auditorium where there was more room. More than 75 residents attended and learned about reconstruction requirements and the findings of the Committee. Again, a lot of time was devoted to questions and answers, both as a group and individually. After the public meeting, a separate session was held with the owners of the substantially damaged properties. A third public meeting is scheduled for December 6, 1999.

Several handouts were given to explain various aspects of the City's recovery and mitigation activities:

- *Repairing Flooded Buildings*
- *Advice to Flooded Property Owners*
- *Mitigation Financial Assistance*
- *Elevating and Relocating a House*

The public meetings and the handouts gave all the participants plenty of opportunities to learn about the floodplain regulations and the mitigation activities being considered by the Planning Committee. They also gave people a forum to state their concerns. At the October 16 meeting, there were no statements of opposition to the Committee's recommendations for the *Interim Report*.

Questionnaire: The public meetings were only one approach to keeping the public informed and obtaining public input into the planning process. To provide a more confidential and statistically based sense of the owners' interests, a questionnaire was distributed at the first public meeting. Copies were also left at public places, such as City Hall, and on the doors of all flooded buildings whose occupants had not responded by the October 8 deadline.

Sixty-three questionnaires were returned. The major findings are shown in the table on the next page. Other findings and resident desires are discussed in more detail in later chapters.

1. Ownership	
Residence; own and occupy as primary	57
Residence; own and occupy as secondary	1
Residence; Own but do not occupy	1
Residence; Rent	1
Business; Own and occupy	2
Business; Own but do not occupy	0
Business; Rent	1
Business	8
Public	7
Church	1
Condo	5

2. Foundation	
Slab	7
Crawlspace	58
Basement	2
Split Level	6

3. Utilities damaged	
Air conditioner	55
Furnace	27
Water heater	25
Electrical service/panel	12

4. Depth of flooding	
Crawlspace only	14
Crawlspace and ducts/joists	9
Basement/Split level lower floor only	3
First Floor flooring only	1
0 – 1'' above the flooring	6
1'' – 2'' above the flooring	13
More than 2'' above the first floor	14

5. Flood insurance?	
Yes	21
No	42

6. Applied for disaster assistance?	
Yes	56
No	7

7. Flooded before?	
Yes	19
No	43

8. Income Range	
$10,000-19,999	7
$20,000-29,999	7
$30,000-39,999	10
$40,000 or more	38

9. Number in household	
1	11
2	21
3	12
4	14
5	3
6	1
7	0
8 or more	0

10. Preferred mitigation alternatives	
Restore to pre-flood condition	
Yes	32
No	8
Restore with mitigation	
Yes	29
No	7
Repair and elevate	
Yes	18
No	9
Build new and elevate	
Yes	11
No	13
Relocate structure	
Yes	7
No	18
Sell structure	
Yes	38
No	6

Resident Questionnaire Summary

Coordination: During the planning process, many agencies were contacted to determine how their programs affect or could support Conway's activities. Copies of this draft *Plan* will be sent to these agencies, which include:

Local agencies

- Horry County Division of Emergency Preparedness
- Horry County Building Department
- Horry County Soil and Water Conservation District

State agencies

- Department of Natural Resources, Flood Mitigation Office
- Department of Natural Resources, State Hydrologist
- Office of the Adjutant General, Emergency Preparedness Division
- Department of Commerce, Community Development Block Grant Program
- Department of Health & Environmental Control (DHEC)

Federal agencies

- U. S. Army Corps of Engineers
- U. S. Department of Agriculture, Natural Resources Conservation Service
- U.S. Geological Survey
- National Weather Service
- Federal Emergency Management Agency (FEMA)
- Insurance Services Office (FEMA contractor for the Community Rating System)

1.4. The next steps

This *Flood Hazard Mitigation Plan* is a draft that has been prepared under the guidance of the City's Mitigation Planning Committee. Adoption and implementation should proceed according to the following steps:

1. Following the public meeting, the Mitigation Planning Committee will review the comments submitted and revise this *Plan* as appropriate.

2. The revised draft will be available for several weeks for public review. Copies will be sent to the agencies listed in the previous section.

3. The Planning Committee will review any comments received and make revisions as needed.

4. The *Plan* will then be submitted to the City Council for adoption.

5. The City Council should include the funds needed to implement the recommendations in future budgets.
6. The people responsible for implementing the action items in Chapter 10 should proceed with their assignments.

6. The people responsible for implementing the action items in Chapter 10 should proceed with their assignments.

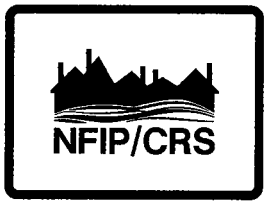
7. The Mitigation Planning Committee should meet at least twice a year to review the progress of *Plan* implementation and report on its findings to the City Council and the media.

1.5. The Community Rating System

This *Plan* recommends that the City apply to the Federal Emergency Management Agency's Community Rating System (Chapter 10, action item 7). The Community Rating System (CRS) provides a flood insurance premium reduction for all policy holders in communities that implement activities above and beyond the minimum requirements of the National Flood Insurance Program. The CRS provides credits for a variety of community flood protection activities, organized under four general series:

300 Public information
400 Mapping and regulatory activities
500 Flood damage reduction
600 Flood preparedness

To receive a CRS flood insurance premium reduction, a community applies to the Federal Emergency Management Agency. This involves application worksheets and presentation of appropriate documentation. FEMA sends a CRS Specialist from the Insurance Services Office, Inc. (ISO) to visit the community. The ISO/CRS Specialist verifies that the activities are being implemented as described in the application.



The community is given points based on the ISO/CRS Specialist's evaluation and verification of the activities. In some cases, additional points are provided for activities that are implemented on a county, regional or state level. The ISO/CRS Specialist is kept abreast of any changes in the Community's program and conducts periodic visits to verify continued implementation.

Benefits: If the community does not have many flood insurance policies in effect, there would be a relatively low direct financial benefit from participating in the CRS. However, more residents should have flood insurance, especially if the City implements the recommended public information programs. The more policies sold, the more people would benefit from the community's flood program, even when it doesn't flood.

More importantly, there are some nonfinancial benefits to the CRS:

- The CRS flood hazard mitigation activities provide enhanced public safety, a reduction in damage to property and public infrastructure, avoidance of disruption and losses, reduction of human suffering, and protection of the environment.

- A community can evaluate the effectiveness of its flood program against a nationally recognized benchmark. Currently, 27 South Carolina communities participate.

flood-related activity or a weakening of the regulatory requirements for new development, should be taken into account by the City Council when considering such actions. A similar system used in fire insurance rating has had a strong impact on the level of support local governments give to their fire protection programs.

– Implementing some CRS activities, such as flood hazard mitigation planning, can help a community qualify for certain federal assistance programs.

In other words, the CRS encourages communities to keep their flood programs going during times of drought and lack of interest. The City of Conway would have to annually recertify to FEMA that it is continuing to implement its activities. Failure to maintain the same level of involvement in flood protection can result in a loss of CRS credit points and a resulting increase in flood insurance rates to City residents. It is expected that this undesirable impact will be an added encouragement to continue to implement this *Plan* in dry years when there is less interest in flooding.

Plan credit: This *Mitigation Plan* is also intended to qualify for CRS credit. It has been prepared in accordance with CRS guidelines. In order to keep the credit, an evaluation report on the City's progress must be submitted to FEMA by October 1 of each year. This requirement acts as additional assurance that this *Flood Hazard Mitigation Plan* will be implemented.

[This page intentionally blank]

Chapter 2. The Flood Hazard

This chapter reviews Conway's flooding hazard. It also notes that the floodplain should not always be viewed as a hazardous area - it provides natural and beneficial functions that can alleviate flooding and improve water quality. At the end of this chapter is a review of what lies in the future along with conclusions and recommendations on hazard data.

2.1. Conway's floodplains

The terrain: The City of Conway lies on the relatively flat terrain of South Carolina's coastal plain. Because of this, stormwater tends to collect and drain away slowly. Ditches and storm sewers are needed to convey stormwater away from developed areas.

Three main waterways collect this stormwater runoff. They are shown on the floodplain map on the next page.

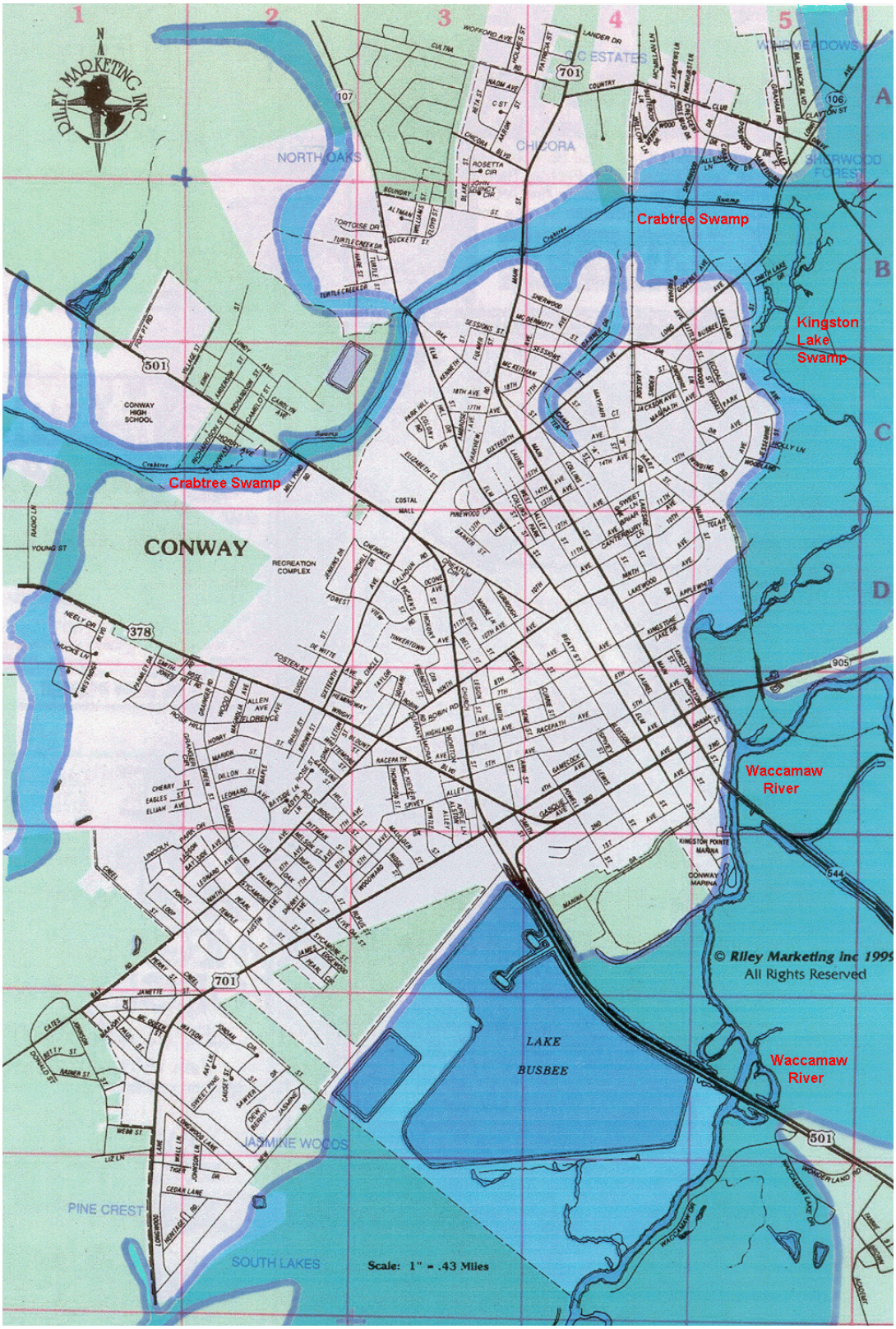
1. The ***Waccamaw River*** is the largest waterway. Its headwaters are in North Carolina. It meanders through the southeastern part of Horry County, along Conway's southeastern corporate limits and enters Winyah Bay in Georgetown County. At Conway, the Waccamaw River has a drainage area of more than 1,440 square miles. The River's slope is so flat that at Conway, over 41 miles from the mouth, daily water levels are affected by the Atlantic Ocean's tides.

2. The second largest waterway is ***Kingston Lake Swamp***. It flows from the northeast along the City's eastern corporate limits and joins the Waccamaw at the southeastern corner. It drains 135 square miles of central Horry County.

3. Drainage from the north and west is collected by ***Crabtree Swamp*** which flows from the west across the northern portion of the city. It has several tributaries inside the City limits. It joins Kingston Lake Swamp at the eastern City limits. While the smallest of the three waterways (drainage area: 18 square miles), Crabtree Swamp has been the source of the most flood problems.

   Crabtree Swamp was originally a swamp. A canal was cut to improve its ability to drain the northern part of Conway in 1966. While this worked to reduce flooding during smaller storms, adjacent lands are still low and subject to flooding from large floods.

The FIRM: Under the National Flood Insurance Program, the Federal Emergency Management Agency (FEMA) published a Flood Insurance Study and Flood Insurance Rate Map for Conway and Horry County. Commonly called the "FIRM," the Flood Insurance Rate Map shows the area affected by the base flood. This area is called the "AE Zone" The approximate boundaries of the AE Zone from the August 23, 1999, FIRM are shown on the map on the next page.



AE Zone or base floodplain. [Approximate boundaries added to base map by French & Associates. This is not an official floodplain map.]

Base floodplain map of Conway

The FIRM is used for more than just mapping information. It forms the basis for two programs. First, all properties in the AE Zone are subject to floodplain regulations. All new buildings in the AE Zone are required to be protected from the base flood. Second, whenever a person receives federal financial assistance or a mortgage, home improvement loan, etc., for a building in the AE Zone, that person must purchase a flood insurance policy.

Gage stage and elevation: The boundaries of the floodplain are defined by flood elevations. Because of confusion during floods, it is important to explain flood "stages" and "elevations."

Several Federal agencies have installed gages on the Waccamaw River. Kingston Lake and Crabtree Swamps have been considered too small for funding agencies to finance a gage. In fact, there has been talk of reducing the number of gages on the Waccamaw to save money.

Each gage has its own datum. A datum is a reference level for measuring height. A gage's datum is the starting point for measuring the river's height or stage at that location. A river stage or flood stage of 15 feet on one gage is not related to stages on other gages.

There is a national datum tied to mean sea level, the National Geodetic Vertical Datum or NGVD. The City's Flood Insurance Study and Flood Insurance Rate Map use NGVD. The Conway gage's datum is 0.65 feet below mean sea level or 0 NGVD. This relationship can be seen in the table below. A *stage* of 13.2 feet at the Conway gage is at the *elevation* of 12.55 feet above sea level (NGVD).

Past Flood Data
Waccamaw River at Conway

Date of Crest	Estimated Peak Discharge (cubic feet/second)	Stage (feet)	Elevation (NGVD) (feet)
October 1924	15,400	11.10	10.45
September 1928	22,000	13.40	12.75
September 1945	15,500	11.20	10.55
March 1959	8,800	8.40	7.75
July 1961	9,600	8.70	8.05
February 1973	9,900	9.00	8.35
December 1994	8,630	8.65	8.00
September 1996	12,000	9.80	9.15
February 1998	14,800	10.25	9.60
Base Flood	22,310	11.75	11.10
September 1999	22,400.*	13.20	12.55

Source: *Flood Plain Information City of Conway South Carolina*, U.S. Army Corps of Engineers, 1973 and U.S. Geological Survey
* 1999 peak discharge estimated by USGS

2.2. Hurricane Floyd

The Storm: On September 16, 1999, Hurricane Floyd made initial landfall across the South Carolina border into North Carolina. The category 4 hurricane was 600 miles wide. Hardest hit areas received as much as 20 inches of rain. The Conway area received over 13 inches of rainfall.

The City was fortunate that the hurricane came during a period of drought and that it did not come inland farther south. If the Pee Dee River basin had also received the rainfall and flooded, the Waccamaw River would not have been able to drain. The resulting flood would have been much higher and would have remained longer in Conway. The National Weather Service's warning models did not recognize the low stages on the Pee Dee River. One result of this is that the Weather Service's flood warning was higher than what actually occurred.

The Floods: Hurricane Floyd brought three different floods to Conway:

1. During the storm, the intense rainfall could not drain away faster than it collected, flooding yards, parks, intersections, parking lots, building entrances and low lying areas. This water drained away as the rainfall intensity decreased.

2. The second flooding event occurred the following day as the Crabtree Swamp watershed responded to the large rainfall. Because this is a relatively small watershed, the runoff from Floyd's rain caused water to rise quickly. Since the Waccamaw was still low, Crabtree Swamp drained quickly. Homes along the Swamp in the north part of the City were only flooded for a few hours.

3. The third flooding event started a few days after the storm when the runoff from the Waccamaw River watershed caused the river to rise. Because the Waccamaw's watershed is so large and flat, it took days for the stormwater runoff to collect and flow into the river. It took days for the flood crest to travel downstream to Conway.

   The River backed up Kingston Lake and Crabtree Swamps, again flooding neighborhoods that were initially flooded the day after the Floyd storm. This flood had the added hazard of water that had been polluted by farm runoff that included livestock waste. The water was much dirtier and more noxious than the water in the other two floods. And it stayed in or under buildings for up to several weeks.

While it is tempting to place all the blame on the flooding on man-made causes (which theoretically should be easier to correct), nature is the major cause of the 1999 and other large floods. Even with no watershed development, the runoff from the amount of rain dropped by Hurricane Floyd would have caused extensive flooding.

To investigate this, the firm of JKB & B Engineering, hired by a Crabtree Swamp neighborhood group, reviewed eleven flooding and rainfall records. It concluded "from the available information that the flooding experienced in the area is at least primarily caused by the [backwater of the Waccamaw] river levels rather than by development upstream on the Crabtree Swamp."

Flood discharges: The gage used by the National Weather Service for the Waccamaw River at Conway is located at the Conway Marina at the end of Elm Street. The Waccamaw River crested on September 26 (and again on the 27th) at river stage 13.2 (12.55 NGVD), lower than originally predicted.

The table on the page 2-3 shows the peak discharge, which is the amount of water in cubic feet per second that flows past the gage during the crest. It is important to note two things from this table:

1. Conway has a history of flooding. While the 1999 flood was bad, the 1928 flood was slightly higher.

2. At their peaks, the 1928 and 1999 floods carried practically the same amount of water as the regulatory base flood, roughly 22,000 cubic feet per second.

This second finding is important. The base or "100-year" flood is the basis for FEMA's National Flood Insurance Program regulations. It is possible, but not common, for the base flood to be exceeded twice in 70 years. French & Associates' review of the Horry County Flood Insurance Study found several concerns that question the accuracy of the base flood discharge, including:

- Too short a record at the Conway gage
- Use of a regional regression equation not calibrated to other gages with longer history
- Use of a regional regression equation not reflective of the Crabtree Swamp canal
- Use of a regional regression equation not reflective of recent watershed development
- Study completed in 1995, without the benefit of data from the 1996 and 1998 floods

These technical concerns have been passed on to FEMA and the South Carolina Department of Natural Resources.

Flood elevations: While the discharge is similar to the 1928 and 1999 floods, the base flood elevation is 1.5 feet lower. This means that if the base flood discharge is correct, the base flood elevation used for regulating floodplain construction underestimates the hazard. Possible reasons for this are:

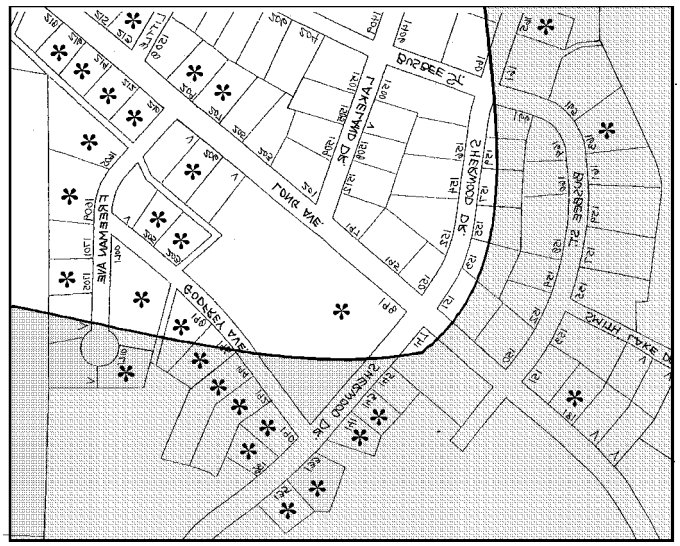
- The discharge - elevation rating curve for the gage may underestimate the discharge so the 1999 and 1928 flood discharges were significantly higher than the base flood's.
- The area available to carry the flood is narrower than the Flood Insurance Study's model shows, resulting in a greater backwater effect and higher flood levels.
- Development, vegetation, etc. in the floodplain reduces the velocity of the water more than accounted for by the Study's roughness coefficients.
- The starting 100-year water surface elevation for the Study was too low.

These are suppositions that would need to be confirmed by a detailed restudy of the Waccamaw River.

FIRM problems: Another problem with the FIRM is that it inaccurately shows the boundaries of the AE Zone. If the map were accurate, all AE Zone properties would have been flooded at least one foot deep during the 1999 flood (because the flood was 1.5 feet higher than the base flood elevation used to prepare the map). Properties outside the AE Zone would not get more than 1 - 2 feet of water.

Properties with buildings that received two or more feet of water in 1999 were plotted on the map shown on the right (the area outlined in green on the map on the next page). It can be seen that there were many properties in the AE Zone that did not receive two feet of water and there were many outside the AE Zone that did.

Flood Hazard Areas



AE Zone (base floodplain shown on the FIRM)

Property where the 1999 flood was over two feet on the outside wall of the building.

Properties with a "V" and no address are vacant.

Another example of this problem is seen in the map on the next page. It shows several streets in the downtown and in the area outlined in green that were closed by flooding, even though they were several blocks from the mapped AE Zone.

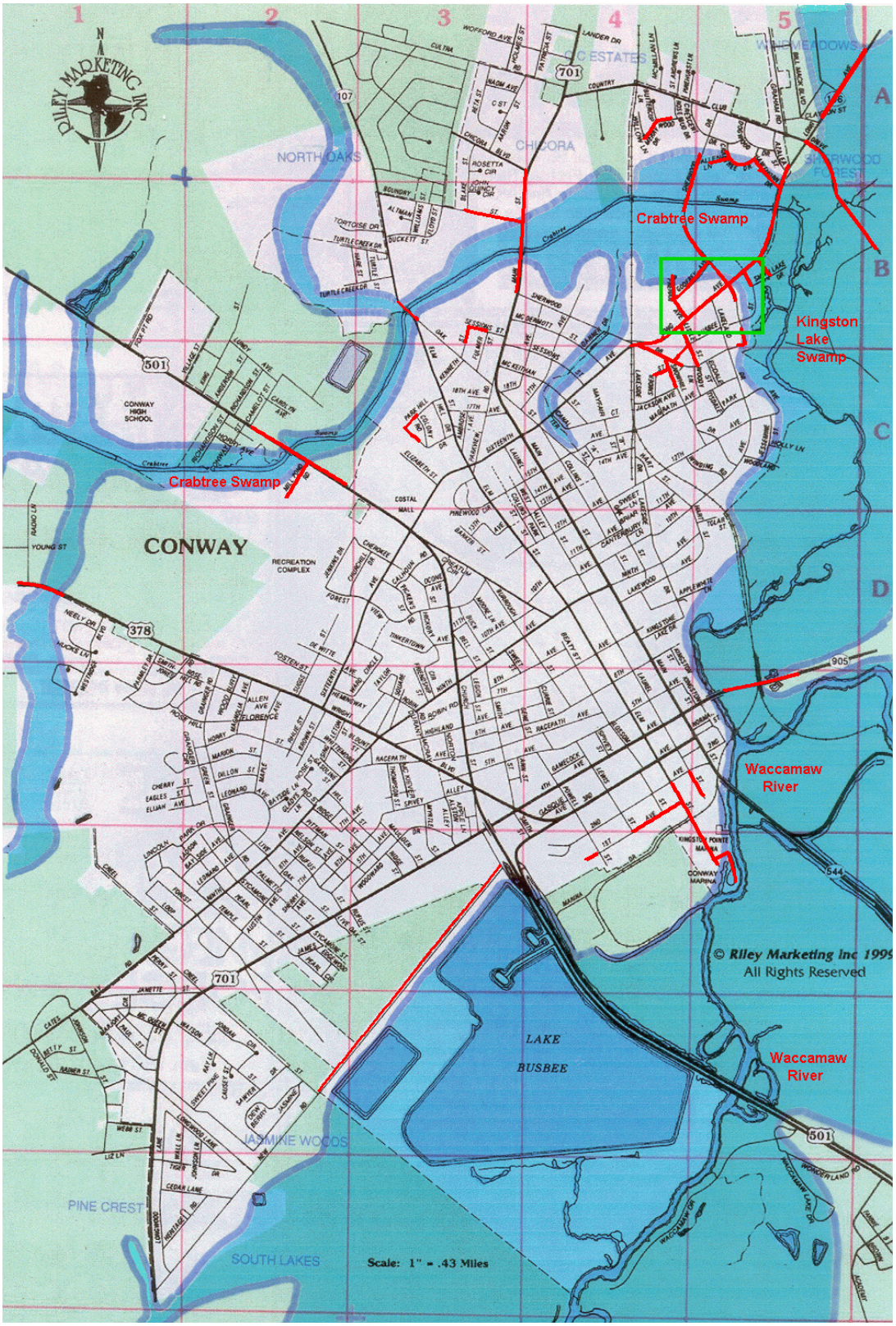
One unfortunate result of this mapping problem is that programs that used the FIRM gave people a false sense of security. Many people who were flooded were not told to purchase flood insurance. Only 1/3 of those responding to the mitigation planning questionnaire had insurance coverage (see page 1-6).

Because of these FIRM shortcomings, the Mitigation Planning Committee recommended that the City's floodplain development and reconstruction regulations use the 1999 flood crest as the regulatory flood elevation. The City Council subsequently adopted this recommendation by amending the floodplain regulation ordinance on October 25.

Standing water destroyed wooden flooring and walls in most flooded buildings.

Flood losses: The full extent of the impact of Hurricane Floyd has still not been measured. Here are the preliminary estimates:

– At least 90 homes and 10 businesses were damaged enough to need building permits to make repairs.



Streets closed during the 1999 flood.

Area shown in map on page 2-6.

Streets closed during the 1999 flood.

– An estimated 50 more buildings had water in or near the crawlspaces but did not suffer any structural damage. However, many received damage to their outside air conditioning units, garages, and/or landscaping.

– Several sewer lift stations were damaged by flooding, in spite of a major sandbagging effort (see photo, page 6-7).

– Over 25 streets and bridges were closed (see map, previous page). Backups of several miles were common on the state highways during the flood.

– An untold number of families and businesses were disrupted due to direct flood damage or closing of the streets.

– There were very few reports of health problems, in spite of the heavily polluted water.

2.3. Local drainage

Local drainage problems occur throughout the City. As noted at the beginning of this chapter, Conway lies on the relatively flat terrain of South Carolina's coastal plain. Because of this, stormwater tends to collect and drain away slowly.

Local drainage problems have four causes:

– Ditches and storm sewers are needed to convey stormwater away from developed areas. In some areas, the "lay of the land" means surface water doesn't drain quickly to a ditch, stream or storm sewer.

– Storm sewers and culverts may be too small to carry heavier flows. Flows increase as watersheds develop and runoff increases. A storm sewer built to carry a 10-year storm in 1970 may be inadequate to carry the amount of runoff from a 10-year storm that falls on today's more urbanized area.

– Storm sewers, ditches and other waterways can be blocked by debris. Stormwater sits for hours or days, waiting for the sewers to clear.

– Local drainage problems can be aggravated by property owners who do not realize the repercussions of their actions. Roadside ditches and swales between buildings are often filled by owners who want a flatter yard that is easier to mow. Some dump their yard clippings and other waste into the nearest ditch, adding to the debris that dam or plug the channel.

Local drainage problems occur during heavy local rains. During Hurricane Floyd's rains, streets and ditches filled up quickly. Many properties outside the mapped floodplain were flooded as the runoff made its way to the three receiving streams. Because these problems occurred all over town and generally did not require building permits for repairs, there are no estimates of the number of buildings affected or the total damage.

Conway is not alone with this problem. As reported by the Horry County *Comprehensive Plan*:

> The county has an extremely flat topography, highly erodible soils, and semi-tropical climate with periods of intense rainfall. Urban development adds to the flow and speed of stormwater traveling through system. Current drainage structures cannot accommodate the resulting runoff because of poor design, inadequate maintenance, and underinvestment in necessary infrastructure. (Page V-39)

2.4. Repetitive losses

As noted in the table on page 2-3, Conway has been subject to repeated overbank flooding. Property owners along Crabtree Swamp were quoted as having been flooded "7 times in 11 years" and "11 times in 21 years, twice in the house." Conway has also had numerous storms that caused local drainage problems.

A "repetitive loss property" is one which has received two flood insurance claim payments for at least $1,000 each since 1978. These properties are important to the National Flood Insurance Program because they account for one-third of the country's flood insurance claim payments. Therefore, FEMA programs encourage communities to identify the causes of their repetitive losses and develop a plan to mitigate the losses.

Conway has 11 FEMA-designated repetitive loss properties:

7	were flooded by the Waccamaw River floods shown in the table on page 2-3
3	are in an apartment complex with a local drainage problem, not in the mapped floodplain
1	is outside the City of Conway
11	

Repetitive Loss Plan: The official NFIP repetitive loss designation understates the real problem. Rather than focus attention on ever changing NFIP repetitive loss designations (which is dependent on people having flood insurance policies and submitting claims), Conway considers the entire City as a repetitive loss area. This *Flood Hazard Mitigation Plan* covers all types of flooding throughout the City and will therefore be the official repetitive loss plan credited by the Community Rating System.

2.5. Natural and beneficial floodplain functions

Floodplains serve many functions besides carrying or storing floodwaters. They provide habitat for flora and fauna, groundwater recharge, and recreational and aesthetic opportunities. These natural and beneficial functions include:

- Storage of flood waters
- Shallow infiltration to absorb overland flood flow
- Lowering peak flood flows by slowly releasing storm water over time
- Deep infiltration to recharge aquifers
- Filtration of hazardous materials and excessive nutrients
- Habitat for riparian species

Wetlands: One key determinant of an area's natural value is whether it is designated as a wetland. Wetlands provide habitat for species that cannot live or breed anywhere else. They reduce flood velocities and erosion. Wetland vegetation filters water, making it cleaner for those downstream.

According to the South Carolina Land Resources Commission, approximately 45% of all land in Horry County is considered to be wetlands. This percentage is slightly higher in the Conway area. This represents a tremendous resource that can provide flood protection as well as be inappropriate land for development.

Water quality: The South Carolina Marine Resources Institute Tidal Creek Project studied pollution in undeveloped and developed watersheds and the impact on tidal creeks. There conclusions are applicable to the Conway area: the more impervious surface in the watershed, the greater the magnitude of impact by pollution. With more than 30% impervious surface, the study showed that flow patterns were altered, stream geomorphology was impacted, and levels of contaminated sediment were high enough to harm aquatic life. In short, the natural and beneficial functions are adversely affected by watershed development.

Riverfronts: In addition to the natural benefits provided by floodplains, the riverfronts can provide scenic and interesting settings for parks, trails and other recreation facilities. The City has recognized this by constructing the Crabtree Swamp trail.

The City also created the Waccamaw Riverfront District to better manage development along the Downtown portion of the Waccamaw River. In the district is the Riverwalk. In addition to attracting people to local businesses, the Riverwalk has proven to have many spin off benefits. As noted in the City's Comprehensive Plan,

> Certain features were incorporated into the design of the riverfront: the curving banks of the Waccamaw were preserved and the natural beauty of the river was enhanced to create a space accessible to the public. Design guidelines were written for the Riverfront District to ensure that future development will blend with the natural features of the river and the river boardwalk. Property owners granted riverfront easements for the "Riverwalk" and approximately $1.5 million in grants and general funds were secured for the project. Private property owners began to reinvest in their property once initial public investments were made for the Riverwalk....

The Riverwalk is now the center of activity in the Waccamaw Riverfront District. The Riverwalk provides leisurely open space where the community gathers for festivals and events that celebrate the heritage of the rivertown....

The Riverwalk is an excellent example of a beneficial floodplain function. Conway has the potential to create more scenic riverfront settings that benefit both flood hazard mitigation and economic development.

"The Conway community offers many aesthetic landscapes, riverbanks, and natural beauty that captivates local artists."
– Comprehensive Plan, p. 50.

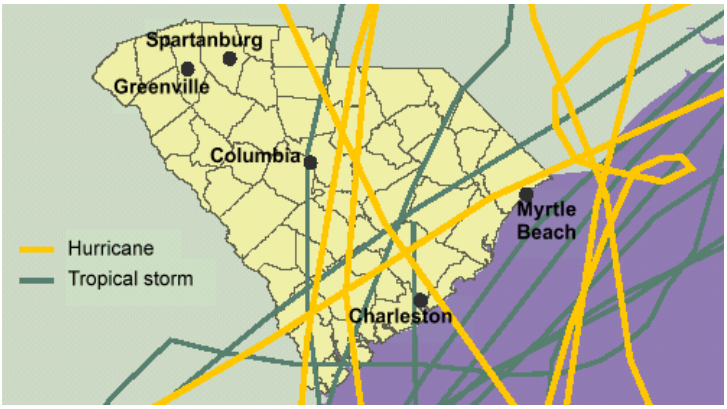
2.6. Other natural hazards

Flooding is not the only natural hazard facing Conway. The others are not confined to a specific area, like the floodplain. While the maps may appear to show that these hazards are greater south of the Conway area, it must be remembered that the maps are of historical occurrences and that Conway can be affected by these hazards, even if their eyes or epicenters are miles away.

The source for much of this material is the *South Carolina Atlas of Environmental Risks and Hazards*, published by the University of South Carolina, 1999.

Hurricanes: The most destructive natural forces are hurricanes (winds greater than 73 miles per hour) and tropical storms (winds less than 74 MPH).

The first recorded hurricane to hit South Carolina was in late summer of 1686. It destroyed crops, trees, boats, and buildings. Since then, the State has been hit by more than 45 hurricanes or major coastal storms.



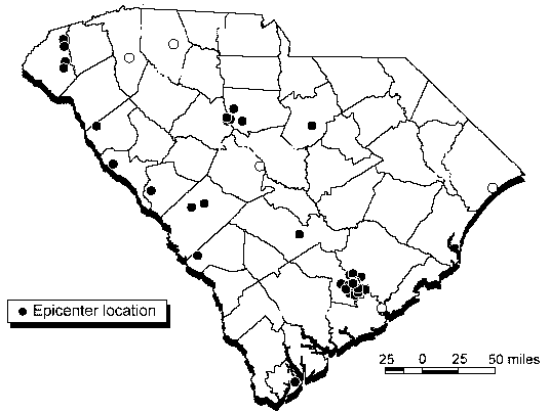
Hurricanes and Tropical Storms since 1975

Source: *South Carolina Atlas of Environmental Risks and Hazards*, University of South Carolina, 1999

As seen in the adjoining map, the Conway/Myrtle Beach area has been luckier than the central part of the state over the last 25 years. Nineteen hurricanes or tropical storms have affected the state since 1975. Approximately 118 people died in these storms, although not all of them were killed in South Carolina. These 19 storms and hurricanes caused more than $11.5 billion in damages, again, not all of this confined to the state.

Damage from Hurricane Hugo dwarfs all other disasters in South Carolina's history. The statistics are staggering: 264,000 people evacuated, $2 billion in agricultural damage, the second largest claim event in the history of the National Flood Insurance Program, etc. Luckily its worst fury was spent on a relatively undeveloped area north of Charleston and south of Conway.

Earthquakes: During the past 21 years, there were more than 200 recorded earthquakes in South Carolina. Most of these were located in the Summerville area, northwest of Charleston. There is a major seismic zone in the coastal plain with the northeast-southwest trending Woodstock Fault.



Earthquake epicenters: 1975 - 1996

Source: *South Carolina Atlas of Environmental Risks and Hazards*, University of South Carolina, 1999

Most of the earthquakes that affect South Carolina are minor in magnitude (less than 3.0 on the Richter scale). This means that very few of them are ever felt by people and can only be detected because of very sensitive instruments called seismometers. On occasion, however, the State does experience stronger earthquakes (greater than 3.0), especially in the Charleston area. The historic Charleston earthquake of 1886 is one of the strongest earthquakes recorded in the eastern United States.

Wildfire: March is historically the worst month for wildfires. The majority of South Carolina wildfires are caused by debris burning (30- 35%) and arson (40-45%).

There is a distinct geographic burn pattern. The Midlands and Piedmont regions have smaller fires, while the outer coastal plain and the coastal counties have larger fires. South Carolina experienced over 93,000 wildfires between 1979 and 1995, 3,788 of them in Horry County. Most wildfires averaged fewer than 6 acres per fire. Horry County's burned 29,050 acres for an average of 7.6 acres.

The largest forest fire in South Carolina history occurred in Horry County in 1976. Caused by an unattended campfire, the fire raged for 5 days. More than 100 firefighters were needed to bring the 30,0000-acre blaze under control. Unconfirmed reports indicate that a much larger wildfire outbreak may have burned up to 3 million acres of forest land and caused several deaths in 1898.

Mitigation: Other natural hazards are not so threatening. These include drought, winter storms, lightning and hail.

For most of the hazards, there are two prime mitigation measures: emergency preparedness/evacuation and building codes with wind and earthquake protection standards.

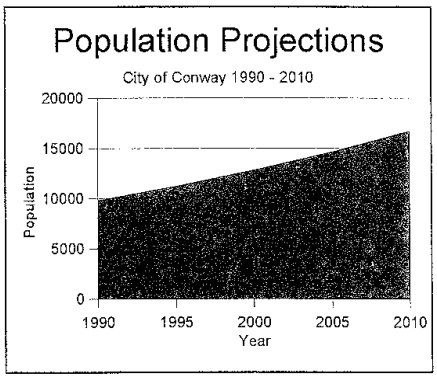
With careful planning, these mitigation measures dovetail well with flood hazard mitigation strategies and measures. It is important to keep these hazards in mind when designing flood protection measures. For example, elevating buildings to protect them from flooding requires additional safeguards for the wind and earthquake hazards.

2.7. Development trends

Floods are caused by nature. However, *flood problems* are caused by human development. Development has been located in the floodplain and in low areas with local drainage constraints. Development in the smaller watersheds has increased the runoff to these floodprone areas.

An aerial photograph taken in 1968 does not show any streets or buildings in the Godfrey/Freeman area (see map, page 2-6). There are now eight homes in this area substantially damaged by the 1999 flood, all of them built between 1968 and 1979.

Development can be expected to continue. While Conway is predicted to increase in population by 30% over the next 20 years, the growth pressures in the County are even greater. Horry County is the fastest growing county in South Carolina and more than doubled its population during the 20-year period of 1970 - 1990. This growth is expanding the population base from the beach area inland so that now the 14 mile stretch of US 501 between Conway and Myrtle Beach is almost completely built up.



Source: *Shaping Our Futue: Conway 2007*, Comprehensive Plan, 1997

Growth in the watersheds has increased the amount of runoff into the rivers and it, too, is continuing. While new watershed development includes required detention, there are questions of whether existing basins are doing their jobs and whether the stormwater management standards are sufficient (see Chapter 5).

Development constraints: Generally, future development is impeded by one or more of four types of constraints:

1. ***Physical features***, such as steep terrain or bad soils: "In recent years the pressure from new developments has resulted in an increased amount of construction on unsuitable soils..." (Conway's comprehensive plan, page 38). The existence of bad soils and wetlands has not stopped development in Horry County. It simply adds to the cost which people are willing to pay in order to live in such a pleasant area with so many recreational opportunities.

2. A slow economy and ***slow or no growth***: This also does not apply to the Conway area.

3. The ***desires of property owners***: As reviewed in Section 5.4, 95% of Conway's floodplain is still in private ownership. The larger parcels are owned by corporations. Private owners are less likely to restrain growth on their lands. If past trends are an indicator, much if not most of the privately held lands will be sold for development.

4. Stringent development ***regulations***: Less than 1% of the floodplain is zoned conservation/preservation. The rest is zoned to allow residential or commercial development.

In short, only enlightened ownership, public ownership or new regulatory standards will curb the increase in flooding problems that will result from continued development.

2.8. Conclusions

1. Conway is subject to overbank flooding from Crabtree Swamp, Kingston Lake Swamp and the Waccamaw River and to local drainage problems. A comprehensive flood hazard mitigation program should address both types of problems.

2. The Flood Insurance Rate Map's base flood elevation underestimates the true hazard presented by the base flood. Buildings constructed according to the minimum FEMA standard would not be protected from a recurrence of the 1928 or 1999 floods.

3. The FIRM inaccurately shows the properties affected by the base flood. As a result, many property owners were unaware of the true hazard and many were not told to purchase flood insurance.

4. The City should continue to use the elevation of the 1999 flood as the basis for protecting new construction and redevelopment from flood damage, until a restudy is conducted, reviewed and accepted.

5. Flooding following Hurricane Floyd has resulted in damage to 150± properties and disruption to all residents, businesses and travelers.

6. Floodplains provide natural and beneficial functions and improve the recreational and economic development opportunities for City residents. A flood hazard mitigation program should preserve and capitalize on these benefits.

7. Conway is exposed to other natural hazards besides flooding. A flood hazard mitigation program should bear in mind these hazards and their mitigation measures.

8. A separate repetitive loss plan is not needed. In order to address all sources of repetitive flooding, this *Flood Hazard Mitigation Plan* should be considered as the official repetitive loss plan needed for Community Rating System recognition.

9. Development trends will likely increase flood losses. A flood protection program should include measures to protect new development from increased damage expected from future flooding.

Chapter 3. Goals and Objectives

Given Conway's flood hazard, natural floodplain functions and development trends as well as the recent experiences after Hurricane Floyd, three general goals are identified for the City's flood hazard mitigation effort. Each goal has three to five objectives that specify how the goal should be reached.

3.1. Existing development

Goal 1. Properties affected by the 1999 flood will be protected from damage from future floods. The top priority is to recover from the 1999 flood and mitigate the impacts from a repeat of such a flood.

Objectives:

1. All substantially damaged buildings will be acquired and cleared from the floodplain or elevated to a level two feet above the 1999 flood.

2. Appropriate flood control, floodproofing and flood warning and response measures will be constructed or installed to protect buildings that were flooded but were not substantially damaged.

3. City properties and lifelines will be protected and functional during the next flood.

4. The runoff from at least the 10-year storm will be stored and/or conveyed by the City's drainage system without blocking roads or damaging buildings.

3.2. Future development

Goal 2. New development and redevelopment will not suffer flood damage and will not increase the flood hazard. The second priority is to ensure that problems are not worsened. This is especially important in light of the development pressures on the City.

Objectives:

1. New buildings, substantially damaged buildings, and improvements to existing buildings will be protected from flooding to a level two feet above the 1999 flood.

2. Floodprone areas and wetlands that are currently open and that have natural and beneficial functions will remain open.

3. The runoff from new developments will be managed so that the peak flows from even large floods will not exceed the peak flows under pre-development conditions.

3.3. Coordination and support

Goal 3. The City's flood hazard mitigation efforts will support and be supported by residents, other programs and other agencies. The City treasury will not be the only source of funds for implementing mitigation projects and programs. Where appropriate, mitigation activities will be integrated with other City objectives, programs and projects.

1. This *Mitigation Plan* will be implemented with financial and technical assistance from state and Federal agencies.

2. Private organizations and local agencies will be familiar with the City's mitigation efforts and will participate as needed.

3. Residents will be aware of the flood hazard they face, will support flood protection development regulations, and will know how to best protect themselves and their property from flooding.

4. Flood hazard mitigation activities will be coordinated with and take advantage of programs to protect and preserve natural resources and water quality.

5. Flood protection, open space preservation and natural resource protection will become important parts of the City's efforts to manage and improve its residential and economic base.

These goals and objectives form the basis for the recommendations at the end of the following chapters and the action items in Chapter 10.

Chapter 4. Flood Control

This is the first of six chapters on flood hazard mitigation strategies. After a general discussion of each measure, there is a short section on "Implementation in Conway." At the end of each chapter, the findings are discussed in a "Conclusions" section which is followed by a list of recommendations.

Structural flood control projects are used to prevent floodwaters from reaching properties. These measures are "structural" because they involve construction of man-made structures to control water flows. They can be grouped under five measures:

4.1 Reservoirs/impoundments
4.2 Levees/floodwalls
4.3 Diversions
4.4 Channel modifications
4.5 Channel and basin maintenance

Common issues: Two things most flood control projects have in common are that they are very expensive and they may affect other communities. Accordingly, most communities look to state or federal agencies to help them design and fund flood control projects.

As long ago as 1966, the U.S. Army Corps of Engineers completed a flood control survey on the Waccamaw River. Several flood control measures were studied, including reservoirs, levees, channel improvements and a diversion canal. The Corps' report concluded:

> "The results of the study indicated that there was not enough damageable property in the Waccamaw flood plain to justify the high cost of the proposed improvements plans."
> – *Flood Plain Information Report*, U.S. Army Corps of Engineers, 1973

In spite of this conclusion, a flood control project continues to be a high priority for many Conway residents. From their perspective, such projects "solve" the problem by keeping water away with little disruption to them. However, structural flood control projects can have the following shortcomings which need to be kept in mind when considering them:

- They can be too expensive for the City to afford.
- They disturb the land and disrupt natural flows, often destroying habitats.
- They require regular maintenance, which if neglected, can have disastrous consequences.
- They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.
- They can create a false sense of security, as people protected by a project often believe that no flood can ever reach them.

Federal help: Two federal agencies are the most active in flood control projects. The U.S. Department of Agriculture's Natural Resources Conservation Service has jurisdiction over smaller streams (watersheds 250,000 acres (390 square miles) or less). This threshold makes the NRCS appropriate for helping on Crabtree and Kingston Lake Swamps. The key contact for any project is the District Conservationist for Horry County.

The U.S. Army Corps of Engineers is the federal agency for flood projects in larger watersheds, i.e., the Waccamaw River. Each project goes through several steps, the first being a feasibility study which the Corps may undertake upon written request from the state or a local government. The first $100,000 of a project study is a federal expense. The cost-share for the rest of the study and the recommended project (if any) is 50-50. Operation and maintenance is 100% non-federal.

The Corps has authority through a House of Representatives resolution adopted on May 13, 1993 to study the Waccamaw River's flooding problems. The study was to investigate solutions to the navigation and environmental restoration problems in the area. However, funding for the reconnaissance phase of the study had not been included in the agency's budget.

Both agencies' programs are discussed further in Appendix A. With either agency, a formal request must be submitted from a local sponsor. Any work on Crabtree Swamp would have to involve the Crabtree Swamp Watershed Conservation District, an agency formed to manage maintenance on the stream following the 1966 channelization project.

4.1. Reservoirs/impoundments

Reservoirs control flooding by holding high flows behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate that the river can handle downstream. The lake created may provide recreational benefits. Wet or dry basins can serve multiple uses by doubling as parks or other open space uses.

Reservoirs are suitable for protecting existing development. They may be the only flood control measure that can protect development close to a watercourse. Reservoirs are most efficient in deeper valleys where there is more room to store water, or on smaller rivers where there is less water to store. Building a reservoir in flat areas and on large rivers may not be cost-effective because large areas of land have to be purchased. In urban areas, some reservoirs are simply man-made holes dug to provide enough room to store floodwaters (see photo, page 5-13).

As with other structural projects, reservoirs:

- Are expensive
- Remove productive land from the tax base
- Require periodic maintenance
- May fail to prevent damage from floods that exceed their design levels
- May eliminate the natural and beneficial functions of the floodplain
- May create a flash flood hazard to properties downstream of the dam

Reservoirs should be implemented after a thorough watershed analysis that identifies the most effective and efficient location for one or more structures and to ensure that they will not increase a flooding problem elsewhere. Because they involve more than one community and are so expensive, they are typically implemented with the help of state or Federal agencies, such as the U.S. Army Corps of Engineers and the Natural Resources Conservation Service.

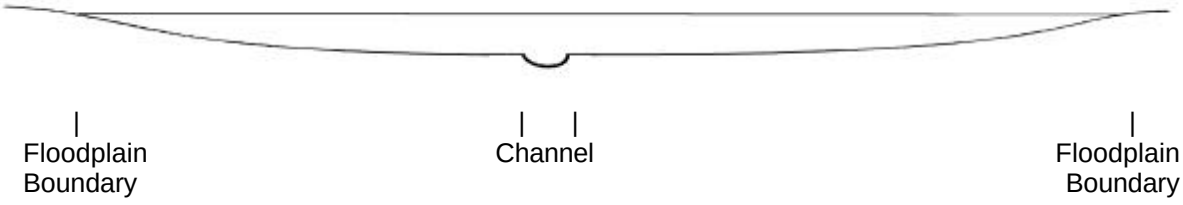
Implementation in Conway: There are no flood control reservoirs on the Waccamaw River or Crabtree or Kingston Lake Swamps. A preliminary review by the NRCS District Conservationist concluded that something similar to a retention dam might be appropriate on Crabtree Swamp. However, a study would be needed to confirm this. A more formal reconnaissance study by the Corps would be needed to verify whether reservoirs on the Waccamaw would be appropriate.

4.2. Levees/floodwalls

Probably the best known structural flood control measure is a barrier of earth (*levee*) or steel or concrete (*floodwall*) erected between the watercourse and the property to be protected. Levees need considerable room to fit between the river and the area to be protected. If space is a constraint, more expensive floodwalls are used.

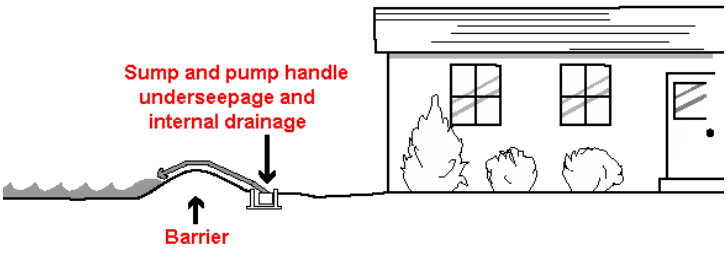
Levees and floodwalls should be set back out of the floodway so they will not push floodwater onto other properties (see the box on page 5-10 for a discussion on the floodway). Their design also should compensate for the flood storage that they will displace and for access through or over the barrier.

Implementation in Conway: There are no levees or floodwalls along the three streams that flood Conway. They may not be desirable in the residential and downtown areas that enjoy the aesthetic view of the river. Since local floodplain overbank areas are very wide, levee encroachments would remove considerable flood conveyance and storage area.



In Conway's wide and flat floodplain, a levee set close to the channel will displace large amounts of water that is stored and conveyed in the overbank floodplain, causing flooding on other properties.

JKB & B Engineering, a consulting firm in Columbia, was hired by a Crabtree Swamp neighborhood association to review their flooding problems. The firm suggested constructing "ring levees" around the homes. Ring levees can be designed to keep the river water away from the structures but rain that falls within the levee must be pumped out. The neighbors did not pursue this suggestion.



Low level ring levee

4.3. Diversions

A diversion is simply a new channel that sends floodwater to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the stream spills over to the diversion channel or tunnel which carries the excess water to the receiving lake or river.

Diversions are limited by topography; they won't work everywhere. Unless the receiving water body is relatively close to the floodprone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive. Where topography and land use are not favorable, a more expensive tunnel must be investigated.

Care must be taken to ensure that the diversion does not cause a new flood problem or adversely affect adjacent property owners. Even the appearance of transferring the flood to someone else greatly complicates – and often halts – a diversion project. Diversion channels may be blocked by residents who don't understand, or don't agree with, their purpose.

Implementation in Conway: A diversion is not practical for Crabtree Swamp because the City of Conway lies between the Swamp and the nearest receiving water, the Waccamaw River.

A diversion for the Waccamaw River has been discussed for a number of years. A group led by Robert Bellemy, Jr., a Myrtle Beach engineer, has recommended a diversion canal from the Waccamaw River upstream of Conway to the Intracoastal Waterway. A canal would be needed to connect the Intracoastal Waterway to the Atlantic Ocean.

The upstream end of the diversion on the Waccamaw River would be a fixed-crest weir on the south bank that would overflow when the water in the river rises above a designated elevation. A lock would be needed on the canal to minimize mixing the Ocean's salt water with the Waterway's fresh water (Myrtle Beach draws its drinking water from the Intracoastal Waterway).

The suggested outlet canal to the Atlantic Ocean would be located at the closed Myrtle Beach Air Force Base. The City of Myrtle Beach and Horry County passed resolutions to ask that a portion of the closed base be set aside for the canal. In an Environmental Impact Statement the US Air Force stated:

> Floodway corridor. The purpose of the proposal was to provide a waterway connecting the Intracoastal Waterway and the Atlantic Ocean to provide flood relief and a boating thoroughfare. The floodway corridor was eliminated after consultation with the U. S. Army Corps of Engineers because of hydraulic and salt water concerns in the Intracoastal Waterway and concerns for protection of marine species in the Atlantic Ocean.

In spite of this conclusion, a diversion has been of great interest to residents. A new reconnaissance study would be needed to determine its feasibility. In a letter dated October 8, 1999, State Senator Dick Elliott urged the Corps of Engineers to rapidly review the diversion proposal. It remains to be seen whether the Corps, knowing of all its shortcomings, will resurrect this approach.

4.4. Channel and drainage modifications

By increasing the conveyance of a stream channel or drainage ditch, more water is carried away. While this benefits those immediately affected, often the extra water will cause increased flooding downstream.

Channel, drainage and storm sewer improvements should be planned through a capital improvements plan. This involves an engineering study to identify where projects would most effectively manage the surface water. A 5-, 10- or even 20-year plan would phase in the projects as funds are made available.

Channel modifications include making a channel wider, deeper, smoother or straighter. Some smaller channels can be lined with concrete or even put in underground pipes. Modifications that result in faster moving water may also increase bank erosion which can lead to undercut properties and downstream sedimentation.

Dredging is one form of channel modification. Dredging is often cost prohibitive because the dredged material must be disposed of somewhere and the stream will usually fill back in with sediment in a few years. As seen in the schematic on page 4-3, lowering the bottom of a stream channel has little impact on the vast amount of waters that flow through the overbank floodplain. Dredging is usually undertaken only to maintain a navigation channel on larger rivers.

Drainage modifications include man-made ditches and storm sewers that help drain areas where the surface drainage system is inadequate or where underground drainageways may be safer or more attractive. Particularly appropriate for depressions and low spots that will not drain naturally, drainage and storm sewer projects usually carry the runoff from smaller, more frequent storms.

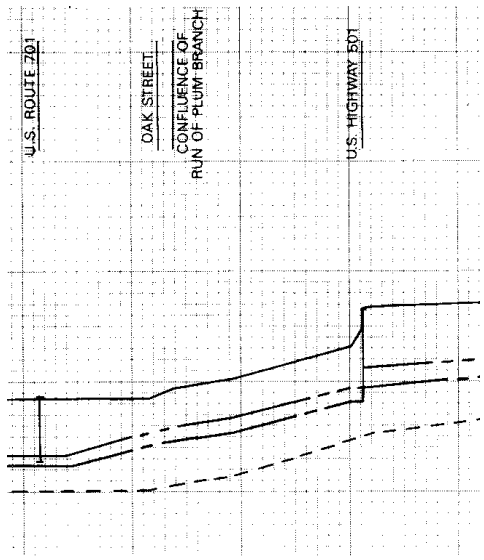
Storm sewer improvements include installing new sewers, enlarging small pipes, street improvements, and preventing back flow. Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving body of water can absorb the increased flows without increased flooding.

Implementation in Conway: Crabtree Swamp was channelized by the Corps of Engineers in 1966. The project included one mile of snagging and clearing in Kingston Lake Swamp and Smith Lake Swamp and about 4.5 miles of channel enlargement on Crabtree Swamp. The local sponsor was the Crabtree Swamp Watershed Conservation District, which is still in existence to maintain the project.

> The project was designed to reduce damages which were frequently caused by small floods and will not provide significant reduction in major flood damages.... The Crabtree Swamp flood plain contains a substantial amount of residential development. Although the flood damage potential along Crabtree Swamp has been reduced by channel improvement and clearing and snagging, there are still many homes that can be reached by large floods.
> – *Flood Plain Information Report*, U.S. Army Corps of Engineers, 1973.

In 1979 a capital improvements plan for drainage was prepared. The *Storm Drainage Study* was drafted by Harwood Beebe Company for the City. The company's engineers inventoried the widespread drainage problems and recommended improvements to reduce the risk of flooding, to maintain natural drainage ways in the natural condition and to help enhance the aesthetics of developed areas.

The *Storm Drainage Study* divided the city into 7 major drainage basins. For each basin, from 2 to 12 projects were identified. There were a total of 56 projects, most of them to enclose open ditches in pipes. It appears that the driving force was to reduce maintenance costs rather than flood control. While pipes are easier to maintain, they usually carry less water at a greater construction expense than open ditches. On the other hand, a free flowing pipe can carry more water than an open ditch that has been obstructed by debris.



Crabtree Swamp's profile shows the effect of bridges on flood heights

Most, but not all, of the projects recommended by Harwood Beebe have been completed. The City has not updated the 1979 report.

The culverts and bridges over Crabtree Swamp and its tributaries could be investigated. A review of the Flood Insurance Study's profiles reveals a "stair step" pattern at several streets and highways. The excerpt at the left shows the difference between the Route 701 crossing (no influence on flooding because of the backwater from the Waccamaw) and Route 501 where the bridge creates nearly a 2 foot increase in the base flood elevation.

4.5. Channel and basin maintenance

Channel and detention basin maintenance is an ongoing program to clean out blockages caused by overgrowth or debris. This work is usually done by a public works or drainage district crew. These activities normally do not affect the shape of the channel or basin, but they do affect how well they can perform.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard not realizing that it is needed to drain street runoff. They may not understand how regrading their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others. Individual actions can add up to big problems.

Therefore, a drainage system maintenance program should include regulations that prevent dumping in or altering watercourses or storage basins. Regrading and filling activities in areas not mapped as floodplains should be regulated to avoid adverse impacts on neighbors. There should

be public information materials that explain the reasons for the rules as well as the penalties. Regular inspections to catch violations should be scheduled.

State law does allow state maintenance of state owned and navigable rivers. Debris has been seen as a major source of bridge failure, so the Department of Transportation has used this authority to keep bridges and culverts clear of debris.

Implementation in Conway: Conway has no formal drainage maintenance program. Channels are cleaned by the Department of Public Works when complaints are submitted and resources are available. The Director of the Department has noted a desire to do more, but is constrained by the funds and resources available.

Since the 1966 channelization of Crabtree Swamp, the Watershed Conservation District has been responsible for its maintenance. Residents within the City have voiced their dissatisfaction with the level of maintenance, although neither the City nor its residents pay into the maintenance fund. As properties are annexed into the city, they are lost from the District's funding base.

A Stormwater Utility

Section 48-14-120 of the state statutes authorizes local governments to establish a stormwater utility. A utility can fund drainage improvement and maintenance programs with fees that are based on the amount of runoff from a property. In essence, it charges "user fees" to everyone who uses the drainage system, i.e., every property owner.

Horry County is in the process of establishing a stormwater utility. This work is being guided by a Stormwater Advisory Committee of County residents. It is addressing only unincorporated areas initially. After it is up and running, cities could participate. One of the first jobs of the Committee is to inventory the County's drainage system problems and develop a capital improvements plan.

If the City participated in Horry County's proposed stormwater utility, it would be able to obtain a more secure source of maintenance funding than the Watershed Conservation District's. It would also better coordinate maintenance and improvement projects with those being considered on the same channels outside the corporate limits.

4.6. Conclusions

1. Structural flood control projects are expensive, can be disruptive to the environment and can give residents a false sense of security. Their shortcomings should be carefully reviewed before the City pursues flood control alternatives.

2. A reservoir may be the most appropriate flood control measure for Crabtree Swamp and one or more reservoirs or a diversion may be appropriate for the Waccamaw River. However, such projects would need careful study to:

   – Ensure that they would actually reduce flooding
   – Ensure that the benefits exceeded the costs of construction and maintenance
   – Assess their environmental impacts
   – Identify source(s) of funding

3. The last time the City reviewed its drainage needs was in 1979. Most of the projects recommended at that time have been constructed.

4. A channel maintenance program will reduce overbank flooding from smaller, more frequent storms and will improve the appearance of the ditches and waterways.

5. Currently channel and drainage improvements and maintenance are the responsibility of the Department of Public Works and the Crabtree Swamp Watershed Conservation District. Both agencies have funding limitations. An alternative funding source is needed.

4.7. Recommendations

1. The City should formally request that the U.S. Army Corps of Engineers conduct a reconnaissance study on the Waccamaw River. The study should review all feasible flood control alternatives, including a diversion.

2. The City should formally request that the USDA Natural Resources Conservation Service watershed project include a flood control study on Crabtree Swamp. The study should review all feasible flood control alternatives, including a reservoir.

3. The City should ask several engineering firms to estimate the time and cost of preparing a drainage needs study and capital improvements plan to succeed the 1979 report. The study should include both current problem areas and areas of expected growth and/or annexation. It should also be coordinated with the efforts of the County's stormwater utility.

4. The City should prepare formal procedures for a drainage system maintenance program. This work should be closely coordinated with the Crabtree Swamp Watershed Conservation District and should follow the guidelines of the Community Rating System.

5. A drainage system maintenance program should include regulations and penalties for dumping and public information activities to educate property owners.

6. The study noted in recommendation #3 should also investigate the benefits and costs of implementing a stormwater utility or joining the County's program.

Chapter 5. Preventive Measures

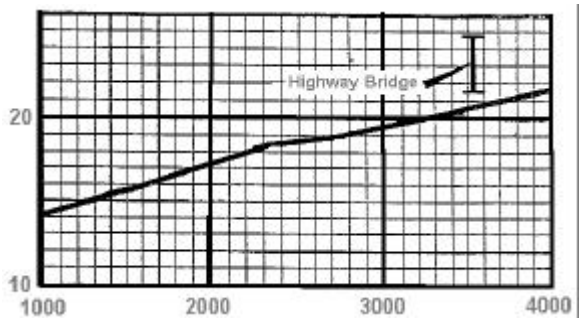
As stated in Chapter 2, "only enlightened ownership, public ownership or new regulatory standards will curb the increase in flooding problems that will result from continued development." This chapter reviews measures that are designed to keep the problem from occurring or getting worse. Preventive measures are usually administered by building, zoning, planning, and/or code enforcement offices. They include:

5.1. Floodplain mapping

Identifying the floodplain is the first step in preventing flood problems. Most of the preventive and public information mitigation measures rely on a map to designate the areas affected and to help set appropriate protection standards.

The term "mapping" include both a spatial display that shows the properties affected by flooding and the background data, such as discharges and flood elevations, that are used as the basis for the map.

One important data source for riverine flooding is the flood profile. Because water runs downhill, the flood elevation is not constant. A profile is a graph that relates flood elevations to horizontal points along a channel as it flows downstream. An theoretical example is to the left. A section from Crabtree Swamp's profile is on page 4-6.



This profile shows the flood elevation at the highway bridge (3,530 feet upstream) to be 20.7 feet above sea level.

The nation's primary floodplain mapping program is conducted by the Federal Emergency Management Agency (FEMA) for the National Flood Insurance Program. Flood Insurance Rate Maps (FIRMs) and their accompanying Flood Insurance Studies provide data on the areas affected by the base or 100-year flood, the 500-year flood, and the regulatory floodway. The floodway is discussed in the Section 5.5 on building construction regulations.

Other agencies support FEMA's program and can prepare their own maps or work under contract to FEMA. The U.S. Geological Survey collects and maintains data from many river gages. Other agencies involved in mapping include the U.S. Army Corps of Engineers, the Natural Resources Conservation Service and the State's Department of Natural Resources.

Implementation in Conway: Conway was provided its first FIRM in 1979. This was last revised when a county-wide map was published in August 1999. The map comes in several panels that show the floodplain and the floodway both inside and outside the City limits. The Flood Insurance Study includes the background data, such as the study techniques, discharges and profiles.

As discussed in Chapter 2, Hurricane Floyd revealed two important shortcomings to the current FIRM. First, either the base flood discharge of the Waccamaw River is wrong or there was an error in determining the base flood elevation. As a result, the base flood elevation used for regulating floodplain construction appears too low. It underestimates the hazard, which means that all measures that depend on the map and the profile will provide an inadequate level of protection and a false sense of security.

The other problem with the FIRM is that it inaccurately shows the boundaries of the base floodplain (the AE Zone). This is seen graphically in the maps on pages 2-6 and 2-7.

Given these two shortcomings, the City Council amended the floodplain regulations by adopting the flood elevations from the 1999 Hurricane Floyd flood as the regulatory flood elevation. This was an interim measure until the situation can be studied and/or a new FIRM prepared.

Initially, regulations can be based on high water reference marks that were set right after the flood (see photo). However, a more permanent record is needed. A profile should be prepared that relates the historical flood heights to elevation in terms of mean sea level (NGVD).

High water reference marks were recorded with red paint (see color photo on cover)

5.2. Comprehensive planning

Comprehensive plans and land use plans identify how a community should be developed (and where development should not occur). Use of the land can be tailored to match the land's hazards, typically by reserving flood hazard areas for parks, golf courses, backyards, wildlife refuges, natural areas, or similar uses.

Generally, a plan has limited authority. It reflects what the community would like to see happen. Its utility is that it guides other local measures, such as capital improvement programs, zoning ordinances, and other land use controls. These plans and regulations guide land ownership and development patterns.

The Local Government Comprehensive Planning Enabling Act of 1994 requires all counties and cities to establish comprehensive plans as a precondition of enacting a zoning ordinance and other land use controls, such as subdivision, landscape and historic preservation regulations.

Local plans must cover seven elements, including community facilities and natural resources. While the latter may include floodplain information, there are no requirements that a plan address natural hazards.

A community's capital improvement program identifies where major public expenditures will be made over the next 5 to 20 years. Capital expenditures may include acquisition of land for public uses, such as parkland, wetlands, or natural areas, and extension or improvement of roads and utilities. A capital improvement plan or program identifies where the public infrastructure will go to support the comprehensive plan's development pattern.

Implementation in Conway: In 1997, the City adopted a comprehensive plan, *Shaping Our Future - Conway 2007* which meets the requirements of the 1994 Planning Enabling Act. The Natural Resources Element provides technical information on:

- climate
- topography
- soils
- wetlands
- flood-prone areas
- Carolina Bays
- wildlife habitat
- trees

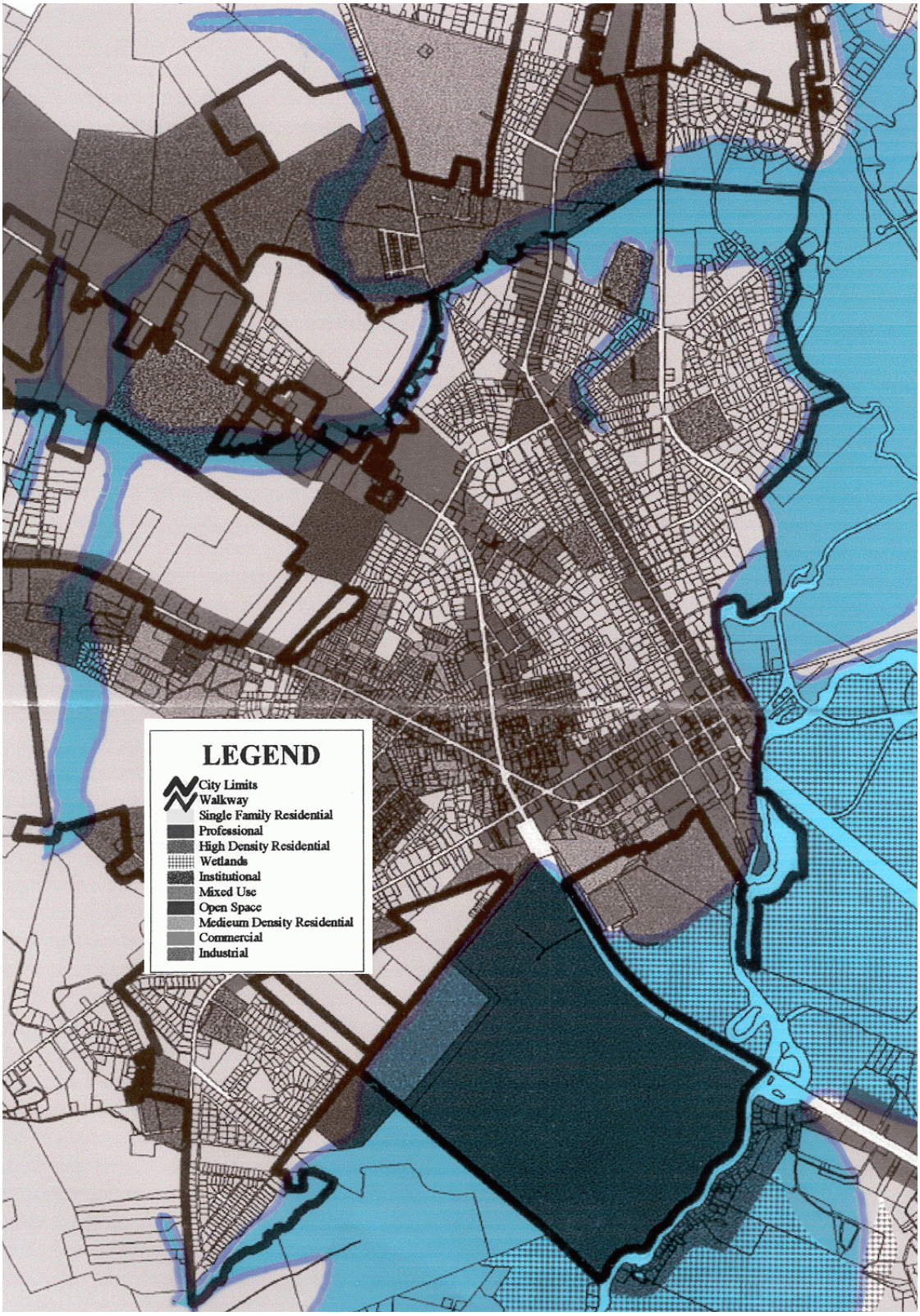
This section of the comprehensive plan notes the drainage problems and development constraints that the natural features of the area impose. For example, under soils, it states that high water tables cause cracked building foundations, corrosion of underground facilities and failing septic tanks. "In recent years the pressure from new developments has resulted in an increased amount of construction on unsuitable soils..." (page 38). The Plan provides some technical data, but the flood-prone areas discussion relies on the Flood Insurance Rate Map.

The Community Facilities and Infrastructure section has four pages on "Stormwater Management and Drainage." These review the 1979 Storm Drainage Study that is discussed in section 4.4 of this *Plan*. It notes that most of the projects have been completed, but "An extensive study of the 1997 city limits and potential future growth areas is necessary to ensure the future stormwater and drainage needs of the community are addressed in a capital improvement program." (pages 66 - 67)

The future land use map is reproduced on the next page with the base floodplain overlaid on it. It can be seen that the 1997 plan intended for the City to set aside a wetlands area along the Waccamaw from development. Kingston Lake Swamp's floodplain is designated for single family residential. Crabtree Swamp's floodplain is mostly single family and high density residential with mixed use along the highway corridors.

The City's plan concludes with a vision statement and 10 goals. Each goal has a series of objectives which provide more specific direction. There are no objectives specifically related to floodplains or flood loss reduction. However, there are objectives that support the drainage system maintenance and drainage improvements recommend in Sections 4.4 and 4.5.

1.1 Upgrade city codes and ordinance relating to nuisances and loitering.
5.8 Prioritize a list of long range capital improvements...
7.2 Enforce city codes concerning junk cars, overgrown lots and dilapidated structures.
7.6 Promote community involvement with functions designed for litter control...



Base floodplain overlaid on the 1997 future land use plan
Parts of the Waccamaw floodplain are designated for wetlands.
All other floodprone areas are planned for development.

There are objectives that call for revamping the regulations on new development and several that specify a City role in encouraging development:

3.1 Revise the city's Zoning Ordinance and Subdivision Regulations
8.1 Recruit developers to Conway who are willing to develop a subdivision where they install the infrastructure, build the homes and sale the homes.
8.4 Complete at least one large-scale water and sewer line extension project to undeveloped tracts of land based on demand.
8.5 Identify tracts of land available for development

There are also three objectives that call for more attention to be given to the riverfront and parks:

3.4 Develop the second and third phase of the Riverwalk
9.1 Encourage and sponsor more riverfront festivals and community outings.
9.3 Educate and organize groups regarding the availability of the riverfront and city parks...

The City has a capital improvements plan, but it is limited to major acquisition for City services, such as vehicles. There is no capital improvements plan for property acquisition or public works projects.

Implementation in Horry County: A comprehensive plan was prepared for Horry County in March 1999. A little over one page in the Natural Resources Element covers floodplains and half of that is on coastal areas. As with the City's plan, it relies on the Flood Insurance Rate Map to define its riverine floodplain areas. One interesting statistic is that 24% of the County's total land area is in 100-year floodplains.

The plan devotes more attention to the natural and beneficial aspects of the area's floodplains, wetlands and waterways. It notes "the coastal waterways and associated habitats... are significant aesthetic and recreational resources. A complete inventory of these scenic resources is needed to conserve open spaces and the county's unique coastal plain environment" (page III-26).

At the end of each section, the County's plan has a vision statement and needs and goals. The natural resource element's goals include:

1. Develop land management strategies that re-orient development patterns to complement the coastal plain landscape of Horry County.
2. Compile and maintain maps describing the natural resources of Horry County for use in suitability analysis to determine the intensity of future development...
5. Ensure water quality is maintained in Horry County through the protection and conservation of the natural function of wetlands and water bodies.

Implementation strategies are presented after the needs and goals. They call for measures that support clearing and preserving the areas closest to the waterways. Among other things, the measures would:

– redirect development away from urban sprawl patterns
– promote conservation of natural resources

- establish a scenic vista program
- establish buffers along waterways
- establish wildlife corridors that create linkages between habitats

The Community Facilities Element provides a succinct summary of the County's stormwater management situation. It covers both water quality and quantity issues. Its concerns are well stated in the needs and goals (page V-40):

Need: The county's current stormwater infrastructure is insufficient to control runoff and prevent flooding.

Goal 1: Ensure the proper maintenance of existing stormwater structures and expand the drainage system.

Need: The county currently lacks a comprehensive policy approach to stormwater management.

Goal 2: Establish a stormwater utility with a comprehensive set of management activities, planned capital expenditures, enforcement mechanisms, and dedicated funding.

5.3. Zoning

A zoning ordinance regulates development and existing uses by dividing the community into zones or districts and setting development criteria for each district. The floodplain can be designated as one or more separate zoning districts that prohibit development or allow only development that is not susceptible to damage by flooding.

Appropriate zoning districts include public use, conservation, agriculture, and cluster or planned unit developments that keep buildings out of the floodplain, wetlands, and other areas that are not suitable for intensive development.

Implementation in Conway: Most of Conway's zoning districts are traditional residential and commercial zones. There is a "conservation/preservation" district. There is only one such designation in a mapped floodplain. It is a 17 acre parcel north of Crabtree Swamp and west of the railroad that is owned by the City.

Elsewhere, the floodplains in the City are zoned as follows:

- Most of the Crabtree Swamp floodplain downstream from Main Street/Highway 701 is zoned "R-1" to allow single family residences.
- Along Main Street and upstream, most of the Crabtree Swamp floodplain is zoned to allow commercial and light industrial uses.
- The Kingston Lake Swamp floodplain is zoned "R-1."
- The Waccamaw River floodplain in the downtown area is zoned "Waccamaw Riverfront District" with special building and landscaping design guidelines.
- Elsewhere the Waccamaw River floodplain is zoned R-1.

5.4. Floodplain open space preservation

Keeping the floodplain free from development is the best approach to preventing flood damage. Preserving vacant natural areas also has recreational benefits and preserves these areas' natural and beneficial functions. These functions include:

- storage of flood waters
- lowering peak flood flows by slowly releasing storm water over time
- absorbing overland flood flow through infiltration
- recharging aquifers through infiltration
- filtration of hazardous materials and excessive nutrients
- habitat for riparian species

Open space can be preserved through a variety of methods, including:

- establishing parks in the floodplain
- acquiring vacant floodprone land
- enacting restrictive zoning requirements to prevent construction of buildings
- requiring buffers or setbacks from a waterway
- purchasing or dedicating easements

The simplest method is to acquire lands and preserve them as parks. There are several alternatives to public acquisition and ownership of open space lands. One is a public-private partnership that shares the load of purchasing, developing and managing the property. Often the financial and legal responsibility can be easier to manage through a public entity and the management is conducted by private non-profit or volunteer organizations.

Easements are another alternative to preserving open space. There are various types, including:

- conservation (the owner agrees to keep it in a natural state)
- public access (the owner agrees to allow public access across the land)
- drainage (the owner agrees to keep the area open for flood flows)
- maintenance (the owner agrees to allow maintenance crews on the property)

In all of these, the owner keeps possession of the land but benefits by a reduction in property taxes. The community benefits by increasing the amount of open space that can be preserved without paying for the full property value and being responsible for maintaining the land. Often a local land trust legally "holds" the easement and is responsible for the annual oversight.

Open space lands and easements do not always have to be purchased. Developers can be required to dedicate park land and flood flow, drainage, or maintenance easements. Maintenance easements also can be donated by existing streamside property owners in return for a community channel maintenance program.

There are several programs, such as those run by land trusts and the Farmland Protection Act, that help finance or provide financial incentives to encourage property owners to set aside open land through easements or sales. For example, more than 40,000 acres in the Ashepoo, Combahee and Edisto River basins were preserved as open space when their owners donated their development rights to land trusts.

The National Park Service, Rivers Trails and Conservation Assistance program, provides staff assistance to communities that want to work cooperatively with citizens and organizations to conserve these types of lands. The program focuses heavily on involving the public in the planning process and encouraging projects that support voluntary participation programs. See Appendix A for more information on this program..

Implementation in Conway: Much of the floodplain in Conway is still in a condition approximating a natural state (i.e., it has not been built on or farmed recently).

There are a little over 1,000 acres in the floodplains of the three streams. Of these 1,000 acres, 95% is still in private ownership. Less than 1% of this is zoned conservation/preservation. The rest is zoned to allow residential or commercial development. Approximately 10% of it is already built on.

The City has five recreational facilities in floodprone areas:

- Conway Marina
- Riverfront Boardwalk
- Riverfront Tennis Center
- Crabtree Recreational Walking Trail
- Jasmine Park and wetlands nature trail

None of these properties preserves much land from development, but they do provide facilities for visitors to the floodplain and they can form the basis for larger parks. There are a couple of other small publicly owned lots in the City's mapped floodplains, but with one exception, these are not necessarily designated for preservation as open space. The exception is a 17 acre parcel north of Crabtree Swamp and west of the railroad that is owned by the City. It is vacant and zoned "conservation/preservation."

The rest of the vacant floodplain properties are in private ownership. The larger parcels are owned by corporations. In sum, roughly 85% of the acreage in Conway's floodplain is still vacant, but most of it is not restricted by ownership or zoning from being converted from open space to buildings.

A link from the western City limits along Crabtree and Kingston Lake Swamps and the Waccamaw River to the historic Main Street and Riverwalk could become 4 miles of an open space corridor. The Crabtree Recreational Walking Trail could form the basis for such a greenway. This corridor could be used not only for flood storage, but also as habitat for wildlife, trails for hiking, and interpretation of the City's history. However, current ownership patterns and regulatory standards do not foster preservation of the area.

Acquisition and conversion to public ownership is the most secure method of preserving open space. While the remaining vacant land along Crabtree Swamp covers a large area, there are relatively few parcels. A check of the current property tax valuations reveals that the parcels in the vicinity of the properties submitted for acquisition on Godfrey Ave and Crabtree Drive could be purchased for less than $150,000.

5.5. Building construction regulations

Zoning and open space preservation work to keep damage-prone development *out* of the hazardous or sensitive areas. Building construction and special use regulations impose construction standards on what is allowed to be built *in* the floodplain. Special use regulations are discussed in the next section.

FEMA's National Flood Insurance Program (NFIP) sets minimum requirements for participating communities' building construction regulations. These are usually spelled out in a separate ordinance. The NFIP minimum requirements are summarized in the box on the next page.

Communities are encouraged to adopt ordinances which are more comprehensive or provide more protection than the NFIP minimum criteria. This is especially important in areas with maps that may not reflect the current hazard. These could include counting improvements and repairs cumulatively, prohibiting certain types of high damage-prone uses from the floodway, or requiring structures to be elevated one or more feet above the base flood elevation.

Implementation in Conway: Conway has participated in the Regular phase of the NFIP since 1979. Its floodplain construction regulations are in the City's Flood Damage Prevention Ordinance (Title 5 of the Code of Ordinances Chapter 2). These were amended on October 25, 1999, to correct some of the mapping problems and other shortcomings revealed by the recent flood.

Conway's ordinance meets the minimum NFIP requirements spelled out in the box on the next page. It exceeds the minimum standards of items 3 and 4.

- Item 3: New buildings must be protected to a level two feet above the crest of the September-October 1999 flood. This is approximately 2½ feet above the base flood elevation shown on the FIRM. The reason for this change is illustrated on page 5-10.

- Item 4: Improvements and repairs are counted cumulatively over a period of 30 years. For example, if an addition were built in 1999 that equaled 20% of a house's value, the owner would only be allowed a total of 30% in improvements and repairs over the next 30 years. If that level was exceeded, the house would have to be elevated to a level two feet above the 1999 flood crest. This can be a particularly tough requirement that is hard to enforce, especially when a building changes hands and the new owner is not allowed to improve it without also undertaking expensive flood protection work.

The ordinance was taken from a national model. It has not been revised to adopt the 1999 maps, although it was revised to adopt the 1999 flood level as the regulatory flood elevation. The October 1999 amendment also transferred responsibility from the Planning to the Building Departments, where it had been in reality for the last several years. Staff have found parts of it confusing and parts not relevant to Conway's situation.

The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA). As a condition of making flood insurance available for their residents, communities agree to regulate new construction in the base floodplain.

There are four major floodplain regulation requirements for inland floodplains. Additional floodplain regulatory requirements may be set by state and local law.

1. All ***development*** in the base floodplain must have a permit from the City. Agricultural and forestry activities are not exempt.

2. Development should not be allowed in the ***floodway***. The floodway is the channel and central portion of the floodplain that is needed to convey the base flood. It is usually the most hazardous area of a riverine floodplain and the most sensitive to development. At a minimum, no development in the floodway can cause an obstruction to flood flows. Generally an engineering study is needed to determine if this will happen.

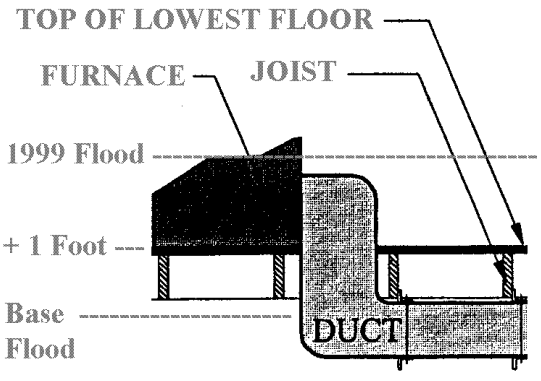
3. New ***buildings*** may be built in the floodplain, but they must be protected from damage by the base flood. The lowest floors of residential buildings must be elevated to or above the base flood elevation. Nonresidential buildings must be elevated or floodproofed.

4. When an ***addition, improvement or repair*** of damage to an existing building is valued at 50% or more than the value of the original building, then it is considered a substantial improvement. A substantial improvement is treated as new construction and the building must be protected from damage by the base flood.

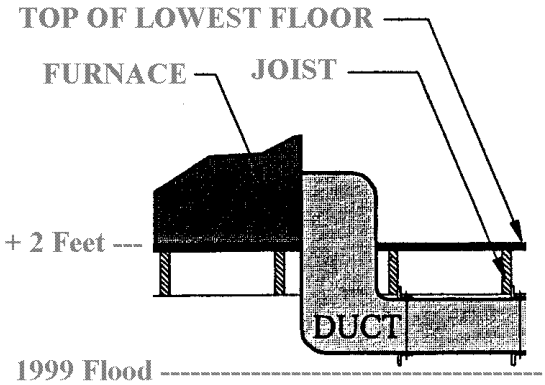
"Development" is defined as any man-made change to the land, including new buildings, improvements to buildings, filling, grading, mining, dredging, etc.

Minimum NFIP Floodplain Construction Regulations

The minimum NFIP floodplain regulations require the top of the floor of new buildings to be constructed at or above the base flood elevation, i.e., 1½ feet below the 1999 flood. Conway's old ordinance required an additional foot of protection.



Old Building Protection Requirement



The *Interim Report* recommended that all new construction (including repairs of substantially damaged buildings) be required to be two feet above the 1999 high water mark to better protect floors, joists and ducts. This recommendation was adopted by the City Council on October 25, 1999.

New Building Protection Requirement

5.6. Regulation of other facilities

Buildings are not the only things that can be built in the floodplain. Other facilities, such as roads, bridges and utility lines, can also be damaged, obstruct flood flows and/or cause other public health or safety problems. Most of these facilities are regulated locally through subdivision regulations. The more complicated ones are regulated directly by state agencies.

Subdivision and other land development regulations govern how land will be subdivided into individual lots. They set construction and location standards for the infrastructure built by the developer, including roads, sidewalks, utility lines, storm sewers and drainageways. These regulations should be based on the development patterns set by the comprehensive plan. They often require that every lot have a buildable area above the flood level.

Some facilities may be exempt from regulation by the City. For example, most communities do not have the authority to regulate another local government. A county hospital or a local school may not have to comply with the City's floodplain regulations.

Implementation in Conway: State agency activities are to comply with a 1982 Governor's Executive Order and their own statutory mandates. The Executive Order required state-owned properties to be built to standards similar to the NFIP requirements (see page 5-10).

The State's *Flood Hazard Mitigation Plan* identified ten State programs that regulate development of other facilities. Only two of these programs have specific standards for construction in a floodplain. The Department of Health and Environmental Control (DHEC) requires wastewater treatment plants to be protected from a 25-year flood, a lesser level than the NFIP requires. Hog farm settling pits and lagoons must be located outside of the 100-year floodplain.

Conway's subdivision regulations include the recently adopted "Land Development Regulations." They cover all subdivision of land into parcels as well as larger projects, such as apartment complexes and shopping centers. The ordinance references the "Storm Drainage Facilities Ordinance" for stormwater standards (see the following section) and requires an erosion and sediment control plan. The ordinance has no flood protection standards, although the applicant's map must show water courses, wetlands, and "all flood boundaries."

5.7. Stormwater management

Development outside a floodplain can contribute significantly to flooding problems. Runoff is increased when natural ground cover is replaced by urban development. Unconstrained watershed development often will aggravate downstream flooding and overload the community's drainage system.

Usually part of a subdivision ordinance, stormwater management regulations require developers to build retention or detention basins to minimize the increases in runoff caused by impervious surfaces and new drainage systems. Generally, new development must not let stormwater leave at a rate higher than it did under pre-development conditions.

Since detention only controls runoff rates and not runoff volumes, there is a need for other measures to enhance the infiltration of stormwater. Swales, infiltration trenches, vegetative filter strips, and permeable paving blocks are recommended additions to the standard detention requirements.

Implementation in Conway: There are three state programs that affect stormwater management regulations:

1. The NPDES (National Pollutant Discharge Elimination System) program is implemented by DHEC pursuant to rules set by the U.S. Environmental Protection Agency. It covers a variety of facilities "associated with industrial activity" and any construction that disturbs five or more acres. Agricultural operations are exempt.

2. DHEC's Office of Ocean and Coastal Resource Management administers the Stormwater Management and Sediment Reduction Act in Horry County. All land disturbing activities greater than two acres must get a permit. The threshold is lower for projects within ½ mile of a receiving waterbody.

   DHEC's regulations require that the post-development runoff peak flows for the 2- and 10-year storms not exceed pre-development peak flows. This helps keep the downstream drainageways from being overloaded during small storms, but does not have much effect on flood flows from larger storms. There is a provision that a larger storm standard may be used "to address existing or future stormwater quantity or quality problems." (Section 72-307.C(4)(a))

   Because the Stormwater Management and Sediment Reduction Act affects smaller properties, it has become the basic stormwater rule for construction projects regulated by DHEC. It is likely that USEPA will revise the NPDES rules to govern projects as small as one acre. In that case, DHEC may defer to the NPDES water quality standards and not require restrictions on the quantity of runoff from new developments.

3. Any development greater than 2 acres that wants to bring runoff to a highway drainage system, must have a stormwater management plan approved by the State Department of Transportation. If the area is less than 2 acres, the developer must show that the post construction 10-year peak discharge does not exceed the pre-development 10-year peak.

Conway's "Ordinance to Establish Regulations and Standards for Storm Drainage Facilities" was enacted in 1981, soon after the comprehensive *Storm Drainage Study* discussed in Section 4.4. It does not specify the size of the development regulated. Residential uses must manage the 10-year rainfall, industrial uses are responsible for up to the 25-year storm.

The City's ordinance is old for a stormwater management ordinance, but it has some good provisions. One is that the developer must account for runoff assuming the maximum land use permitted under the land use plan. One problem with this is that the current land use plan's development predictions have already been surpassed.

There are also some shortcomings in the DHEC and City regulatory standards:

1. The 10- and even the 25-year storm are low thresholds. The national target is now all storms up to and including the 100-year. On small watersheds like the Crabtree, this can make a difference over the next 10-20 years.

2. The requirement that developers build their own little detention basins is not as efficient as (and can be less effective than) constructing larger, regional basins or reservoirs that are publicly maintained.

The Wal Mart shopping center detention basin was filled to capacity during Hurricanes Floyd and Irene.

3. The ordinance could also have more specific standards to avoid disputes, misunderstandings and attempts by developers to install minimal systems.

5.8. Development incentives

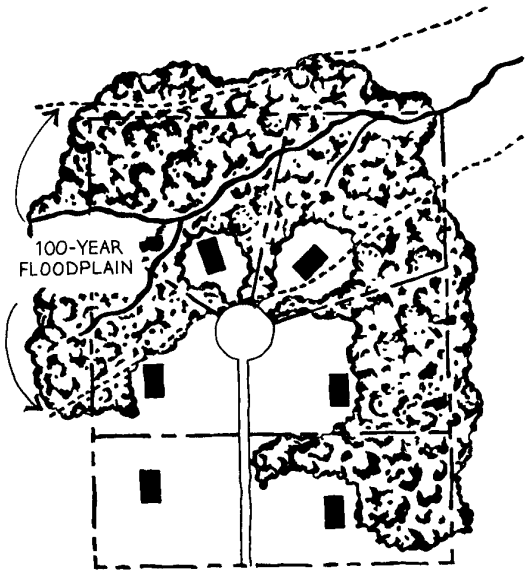
Regulatory approaches react to developers' proposals. They set limits on what private property owners can do, but they do not promote certain types of development. Development incentives are one way a community can take the initiative to encourage appropriate development of floodprone areas.

Various incentives have been devised around the country to encourage developers to settle in a community and/or to exceed minimum zoning ordinance requirements and development regulations. One way to do this is to allow clustering, whereby the same number of homes are allowed, but they are clustered on the high ground so the floodplain can be kept open (see next page). Incentives to encourage this include tax credits and density trade-offs.

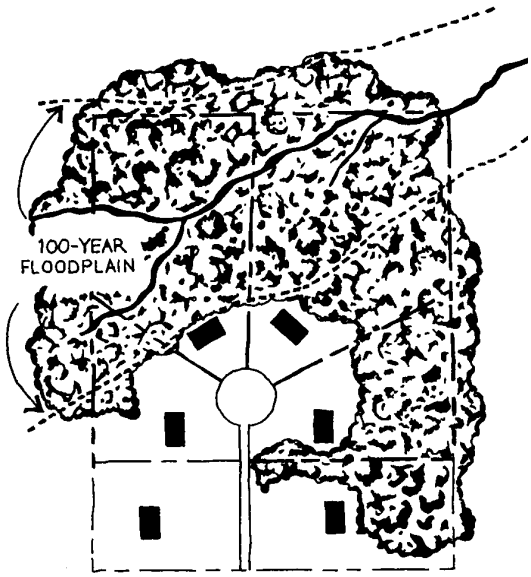
Alternate approaches to stormwater regulations include fee-in-lieu-of detention with fees contributing to a regional or central detention facility.

Implementation in Conway: Conway's *Comprehensive Plan* encourages the City to be proactive in dealing with developers. The City may sign a development agreement that provides a financial benefit for developers when they apply for water or sewer connections at the time of building permit application. This has been used as an incentive to get homes built in the new subdivision.

The city's current procedures do not provide for clustering or other nontraditional approach to a layout for single family homes.



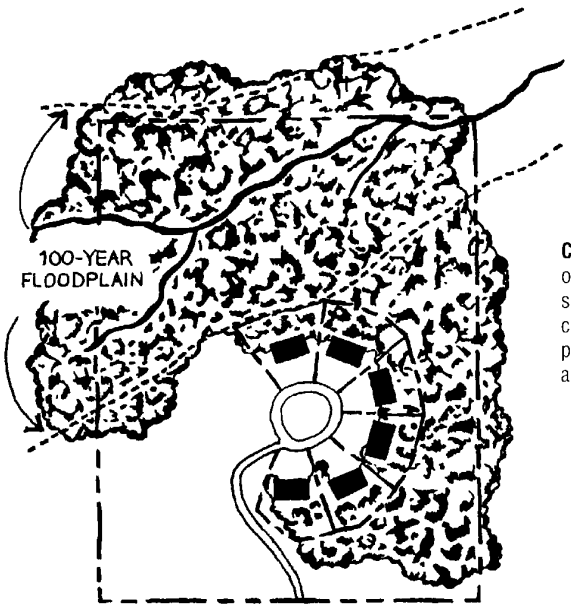
CONVENTIONAL PLAN A



CONVENTIONAL PLAN B

Conventional Plan A: All land on site is subdivided into lots; some lots partially or entirely in floodplain; some homesites in floodplain.

Conventional Plan B: All land on site is subdivided into lots; some lots partially in floodplain; homesites restricted to natural high ground; setbacks and sideyard restrictions modified to accommodate structures out of floodplain.



CLUSTER PLAN

Cluster Plan: All floodplain lands and other sensitive lands kept as open space; net density remains equal to conventional plans; lot sizes reduced to protect natural features; all homesites are on natural high ground.

Clustering allows construction of the same number of units while preserving the floodplain as open space.

Source: *Subdivision Design in Flood Hazard Areas,* American Planning Association, 1997

5.9. Conclusions

1. The base floodplain map for the City, the Flood Insurance Rate Map, has two shortcomings:

   a. The base flood elevation underestimates the true hazard presented by the base flood.

   b. The boundaries on the FIRM inaccurately show the properties affected by the base flood.

2. The City's and County's comprehensive plans do not address flooding beyond the minimum mapping and regulatory criteria of the National Flood Insurance Program. The County's plan recognizes stormwater management and natural resource protection needs and goals and recommends more specific actions to meet them. Both plans support several of the conclusions, recommendations and action items presented in this *Flood Hazard Mitigation Plan*.

3. Much of the floodplain is currently vacant. However, current ownership, the future land use plan and the zoning ordinance will do little to preserve these lands as open space.

4. Building, subdivision, stormwater and other development regulations may or may not have clear and appropriate flood protection standards.

5. Other than in the Waccamaw Riverfront District, the City's development incentives have not been used to encourage better floodplain design or construction practices.

5.10. Recommendations

1. FEMA should review the 1999 flood in light of correcting or revising the FIRM and Flood Insurance Study.

2. In order to provide a more dependable basis for floodplain mapping and regulations, a profile should be prepared that relates the 1999 flood heights to elevation in terms of mean sea level (NGVD).

3. In order to provide a more dependable basis for floodplain mapping and regulations, a more accurate contour map should be developed and used to display the base floodplain boundaries.

4. The City should acquire and/or preserve the remaining wetlands and natural open space areas to develop a continuous trail or greenway along the Crabtree Kingston Lake and Waccamaw. In order to create this comprehensive and substantial community asset, Horry County should also participate in the planning, implementation and long-term management.

5. Conway's future land use plan and zoning ordinance should be reviewed to identify where they can be amended to encourage land uses in the floodplain that are more compatible with the hazard, such as open space, low density development and water dependent uses.

6. The city should continue to enforce the floodplain building regulations as amended after the 1999 flood. However, the entire floodplain management ordinance should be carefully reviewed by the Building Department and revisions recommended that make it clearer to understand and easier to enforce.

7. The City's subdivision and stormwater management regulations should be reviewed to identify changes that would make them more effective in preventing flooding and drainage problems.

Chapter 6. Property Protection

Property protection measures are used to modify buildings or other facilities subject to flood damage rather than to keep floodwaters away. A community may find these to be inexpensive measures because often they are implemented by (or cost-shared with) property owners. Many of the measures do not affect the buildings' appearance or use, making them particularly appropriate for historical sites and landmarks.

Property protection measures include:

6.1 Relocation and acquisition
6.2 Building elevation
6.3 Floodproofing
6.4 Lifeline protection
6.5 Flood insurance

Floodplain owners' interest: Property protection measures are heavily dependent on the interest and support of the owner of the property. To provide a confidential and statistically based sense of the floodplain owners' interests, a questionnaire was distributed to all the properties that were flooded in 1999 (see page 1-5).

Sixty-three questionnaires were returned. The last question was "The City Council is looking at six alternatives for a damaged structure. If financial assistance is available, which of the following alternatives would you consider for your residence/business?" The results showed support for a variety of property protection measures:

Restore the structure to pre-flood condition -	yes: 32	no: 8
Restore the structure with mitigation (examples: elevate utilities, weatherize) -	yes: 29	no: 7
Rebuild and elevate the structure above flood level -	yes: 18	no: 9
Replace the damaged structure with a new one, elevated above flood level -	yes: 11	no: 13
Relocate the structure to another property -	yes: 7	no: 18
Sell the property and buy a new property outside the floodplain -	yes: 38	no: 6

Property owner interests as voiced through the questionnaire

6.1. Relocation and acquisition

Moving a building to higher ground is the surest and safest way to protect it from flooding. While almost any building can be moved, the cost goes up for heavier or rigid structures, such as those made of brick, and for large or irregularly shaped buildings. Experienced house movers know how to handle any job.

Like relocation, acquisition ensures that buildings in a floodprone area will cease to be subject to damage. The major difference is that acquisition is undertaken by a government agency, so the

cost is not borne by the property owner, and the land is converted to public use, such as a park. Acquiring and clearing buildings from the floodplain is not only the best flood protection measure available, it is also a way to convert a problem area into a community asset and obtain environmental benefits.

While relocation and acquisition work against any type of flood hazard, it is more cost-effective in areas subject to storm surge, flash flooding, deep waters, or other severe flood hazards where other property protection measures are not feasible. They are also often justified for properties that repetitively flood, are substantially damaged and/or where the occupants are kept out of the building for extended periods.

Relocation is preferred for large lots with portions outside the floodplain or where the owner has a new flood-free lot available. Acquisition, followed by demolition, is most appropriate for buildings that are too expensive to move -- such as larger, slab foundation, or masonry structures -- and for dilapidated structures that are not worth protecting.

Implementation in Conway: Immediately following the flood in October 1999, the City inspected the 100± buildings that got water in them. Nineteen were determined to be substantially damaged.

One problem with acquisition and relocation is that often the owners do not want to leave. The post-flood questionnaire discussed on the previous page clearly showed support for an acquisition project. The owners of 16 of the 19 substantially damaged homes returned a questionnaire. Every one of them supported the acquisition option. Only one said “yes” to the relocation option. Given the amount and type of damage to the buildings, it is understandable why residents would prefer demolition to salvaging and relocating them.

The *Interim Report* identified several sources of funding that could be used to acquire substantially damaged buildings. It recommended the following:

> The City should apply for funding to pay for 75% of the fair market value of the substantially damaged buildings and their lots....The figures represent approximately 20% of the funds available from the Flood Mitigation Assistance (FMA) and Hazard Mitigation Grant Programs (HMGP). The funding level represents a reasonable request from these programs.
>
> If the funding is received, a property appraiser would prepare a formal appraisal of the pre-flood value of each lot and building. Those without flood insurance would be offered 75% of this appraised amount. For example: if a property is appraised at $100,000, the owner would be offered $75,000. The owner in effect absorbs the difference which is credited to the project as the non-federal share.
>
> Those who did have flood insurance will have the amount of the flood insurance claim payment subtracted from the property value. The offer would be 75% of the balance. For example: If the property is valued at $100,000 and the owner received a claim payment for $60,000, the offer would be 75% of $40,000 or $30,000. In the end, the owner would have received a total of $90,000.
>
> The property owners can decide if they need more than 75% of the appraised value. Whether they were insured or not, they can apply for an SBA loan. This can help pay the costs for a

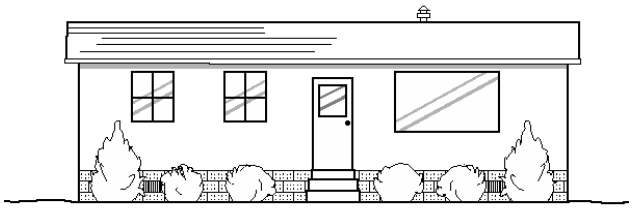
new property. For example: a property was appraised for $100,000 and the owner receives $75,000 for it. There is still a $50,000 mortgage payment. The owner pays off the mortgage and uses the remaining $25,000 plus a low interest SBA loan to purchase a new place. The loan can also help pay for new furniture, etc.

The Committee advised the property owners to carefully review their options. They have plenty of time to think about them while their houses dry out. It was underlined that the program is entirely voluntary. A property owner can opt out any time before an offer is accepted and a commitment to sell is signed.

6.2. Building elevation

Raising a house above the flood level is the best property protection method short of getting the building entirely out of the floodplain. Water flows under the building, causing little or no damage to the structure or its contents. Another alternative is to raise the building and place fill under it before the building is lowered back down, although sometimes buildings on fill look safe and people may feel encouraged to stay in them during a flood.

Elevating a structure will change its appearance. If the house is raised two feet, the front door would be three steps higher than before. If the house is raised eight feet, codes will usually allow the lower area to be wet floodproofed for use as a garage and for limited storage of items not subject to flood damage.



House elevated two feet on crawlspace

Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Commonly practiced in flood-prone areas nationwide, this protection technique is required by law for new and substantially damaged residences located in a floodplain. House moving contractors know the techniques to elevate a building.

During flooding, the building may be isolated and without utilities, and therefore unusable. Another problem arises when newly created lower stories are occupied or used for storage, putting household goods at risk for flood damage.

In addition to cost, three factors may limit use of elevation as a property protection approach:

1. Regulatory restrictions, such as the Americans with Disabilities Act (ADA) and historic preservation rules,

2. Resistance to the appearance of an elevated building, and

3. The need to incorporate wind and seismic protection measures to ensure that the flood protection project does not increase the building's vulnerability to other hazards.

Implementation in Conway: Elevated buildings are not new to Conway. Early construction practices in the area favored the "elevated look." The City Hall is a good example of this architectural approach. The standard practice has been to build single family homes on crawlspace foundations with the first floor two to three feet above grade.

Buildings built in the floodplain since 1979 have been required to be elevated. Several buildings in the floodplain were high enough to escape severe damage by the 1999 flood even though that flood exceeded the regulatory flood level. Therefore, the method is tried and true and appearance is not a major problem.

The regulatory requirements of the Americans with Disabilities Act and historic preservation programs do not affect single family homes, the type of buildings that comprise approximately 90% of Conway's floodprone structures. While the City's building code does require wind and seismic protection standards, they do not add significantly to the cost of elevation.

The *Interim Report* did not recommend elevation for substantially damaged buildings because of the interest in and availability of funds for acquisition. However, one property owner has decided to stay where he is and elevate his substantially damaged home.

6.3. Floodproofing

If a building cannot be removed from harm's way, it can be protected on site. In areas of low flood threat, such as infrequent low velocity shallow flooding, barriers and dry and wet floodproofing can be efficient approaches. These approaches can also be less disruptive to a neighborhood. However, floodproofing a residential building does not qualify for an insurance premium reduction and is not allowed if the project is a substantial improvement or repair of substantial damage.

It must be remembered that during a flood, the building may be isolated and without utilities, and therefore unusable. The streets, utilities and other infrastructure that serve the property will still be exposed to flood damage. This is also a risk to the occupants who may try to get in and out of the building during a flood.

Home with a low floodwall

Barriers: Levees, floodwalls and berms keep floodwaters from reaching a building. They are useful only in areas subject to shallow flooding. They can surround the entire building, tie into high ground, or be as small as a low floodwall built around a stairwell to protect a basement or split-level home.

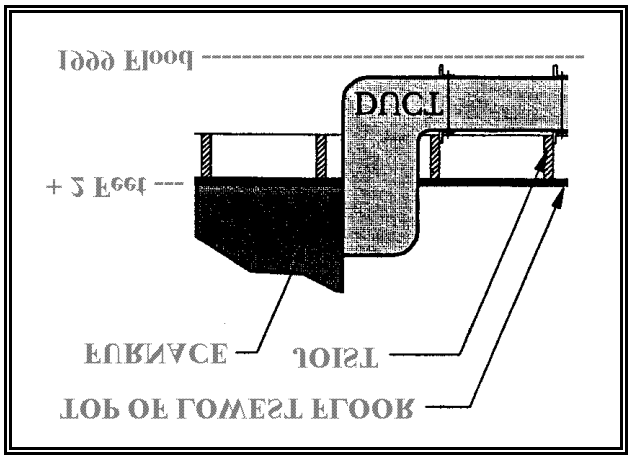
Care must be taken in locating barriers. They must be placed so as not to create flooding or drainage problems on neighboring properties. All barriers must be kept out of the floodway.

Dry floodproofing: Through dry floodproofing, a building on a slab foundation is sealed against floodwaters. All areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings, such as doors, windows, sewer lines and vents, are closed, either permanently with removable shields or with sandbags.

The flood protection level should be no more than 2 or 3 feet above the top of the slab because the building's walls and floors may not withstand the pressure of deeper water. If a nonresidential building is dry floodproofed to one foot above the base flood elevation, there is a flood insurance rate reduction.

Wet floodproofing: This term means intentionally letting floodwaters into an area, but modifying the area to eliminate or minimize water damage. Wet floodproofing techniques can be as simple as moving a few valuable items or as involved as rebuilding the floodable area.

This is the preferred approach for crawlspaces and garages. If damageable items, such as furnaces, air conditioning units and ductwork are removed or elevated above the flood level, a crawlspace can be flooded and be damage free. That is the objective of the recently revised floodplain ordinance for new construction and repairs of substantially damaged buildings (see illustration). For other areas, wet floodproofing is usually considered a measure of last resort, because the modifications needed severely limit use of an inhabited area.



Wet floodproofing has one advantage over the other approaches: No matter how little is done, flood damage will be reduced. Thousands of dollars in damage can be prevented by simply moving utilities, contents and electrical appliances out of the floodprone area.

Implementation in Conway: The majority of the flooded buildings in Conway are houses on crawlspaces. Most of these had water under the flooring and were not substantially damaged. However, their heating, air conditioning and duct systems were often totaled by prolonged contact with the sediment laden water. Electrical circuits that were underwater were also in need of replacement.

Voluntary wet floodproofing was one of the major recommendations of the *Interim Report:*

> Residents and businesses should be encouraged to include floodproofing or retrofitting measures in their building repairs. These could include:
>
> – Moving the electrical box to a level above the high water mark.
>
> – Moving the furnace, air conditioner and ductwork to a higher level. If there's no more room in the crawlspace, the system could be replaced with one in the attic where it will be high and dry....

Several of the financial assistance programs, including FEMA's Home Repair Program and SBA loans can help fund these measures.... [FEMA's program] aims to get people back in their homes quickly rather than pay for housing elsewhere. It covers items deemed necessary for "habitability" of a residence.

People who qualify can receive additional funds for mitigation items, such as

- relocating the main electrical panel to a higher floor
- elevating the furnace or water heater to 1 foot above the experienced flood elevation within the crawlspace or basement but not to another floor.

Barriers or dry floodproofing are more appropriate for buildings on slab foundations subject to shallow flooding. There are several commercial buildings in the Crabtree Swamp floodplain on Main Street that would benefit from these approaches. They would also be useful for the repetitive loss apartment buildings and other slab buildings subject to local drainage problems.

6.4. Lifeline protection

"Lifelines" include roads, railroads, pipelines, power lines, and other utility systems that are used for transportation or communication. They are vital to an area's economic base and, depending on the situation, can be vital for public health and safety.

In most cases, well constructed lifelines can resist the effects of flooding, especially shallow, slow moving floodwaters.

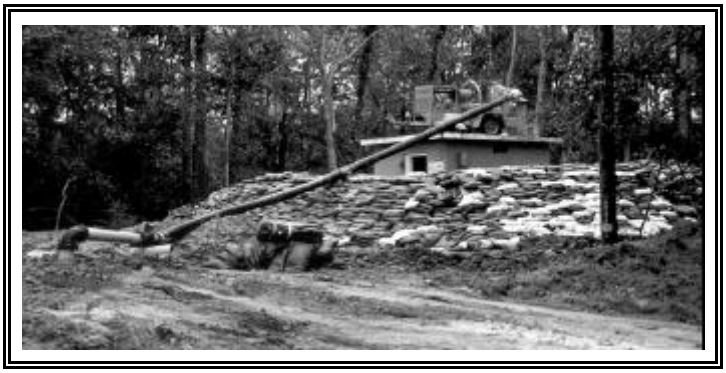
Protection measures vary according to the facility and flood conditions. Well-known engineering practices, such as proper siting and deeper foundations, can protect a new or existing facility, provided there is recognition of the full potential of the hazard.

Implementation in Conway: As discussed in Chapter 2, two types of lifelines were affected by the 1999 flood: streets and sewers. The railroad, power, gas, phone lines all fared without mishap. Power and gas were turned off to most of the flooded areas to prevent fires and other hazards.

Roads: The roads that had to be closed are shown in the map on page 2-7. A preliminary review of these flooded streets and bridges concluded that to raise them above the flood level would create dams that would increase flood heights on other properties. While closed streets are a nuisance, they are preferred over aggravating flooding on others.

There is one exception to this. The complex known as the City Shops, located in the Waccamaw floodplain near Lake Busbee, was cut off by the flood. The 7 main buildings remained dry (some just barely), but approximately 500 feet of the complex' access road was under up to three feet of water. The Department of Public Works had to move its equipment to a temporary location. While there was minimal damage, the Department's operations were greatly complicated during the flood fight.

Sewers: The pump and lift stations to the sanitary sewer system were protected from flooding by a tremendous sandbagging effort. Some were still damaged. These facilities are appropriate for dry floodproofing, a measure much preferred over the temporary and labor intensive approach of sandbagging.



The *Interim Report* recommended the City pursue funding from FEMA disaster or mitigation assistance programs for dry floodproofing the lift stations and the main pump station.

6.5. Flood insurance

Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work. While most homeowner's insurance policies do not cover a property for flood damage, the National Flood Insurance Program does.

Any community can join the National Flood Insurance Program (NFIP) in order to make flood insurance available to its residents. Any insurance agent can sell a separate flood insurance policy under rules and rates set by FEMA's Federal Insurance Administration. Rates do not change after claims are paid; they are set on a national basis.

Implementation in Conway: Conway has been in the NFIP since 1979. Currently approximately 120 properties are covered by flood insurance. Since 1978 (not counting the 1999 flood), 85 claims have been paid for a total payment of over ½ million dollars.

In spite of these numbers, Conway's floodplain is under insured. The resident questionnaire showed that only one out of three (21 out of 63) respondents carried flood insurance. Of those who had insurance, all but two were located in the FIRM's AE Zone.

Only six of the substantially damaged properties were covered by flood insurance. None of the substantially damaged buildings outside the mapped floodplain had flood insurance.

As noted in Chapter 2, the Flood Insurance Rate Map inaccurately displays the true floodplain, so even with full enforcement of the NFIP's mandatory purchase requirement, banks and lenders did not require flood insurance everywhere it was needed.

These facts show that more properties in Conway need flood insurance coverage. Hopefully, the publicity following the flood and the insurance purchase requirement of the disaster assistance programs will change this.

6.6. City support

Most property protection measures are implemented by the property owners. However, local government can promote and assist them in several ways.

Public Information: Providing basic information to property owners is the first step in supporting property protection measures. Owners need general information on what can be done. They need to see examples, preferably from nearby. Public information activities that can promote and support property protection are covered in Chapter 9.

Financial Assistance: Communities can help owners by helping to pay for a retrofitting project, just like they pay for flood control projects. Financial assistance can range from full funding of a project to helping residents find money from other programs. Some of these programs are discussed in Appendix A.

Less expensive community programs include low interest loans, forgivable low interest loans and rebates. A forgivable loan is one that does not need to be repaid if the owner does not sell the house for a specified period, such as five years. These approaches don't fully fund the project but they cost the community treasury less and they increase the owner's commitment to the flood protection project. Often, small amounts of money act as a catalyst to pique the owner's interest to get a self-protection project moving.

Non-financial Incentives: Sometimes only a little funding is needed to motivate a property owner to implement a retrofitting project. A flood insurance premium reduction will result if a building is elevated above the flood level. This reduction is not enough to take much of a bite out of the cost of the project, but it reassures the owner that he or she is doing the right thing.

Other incentives to consider are computer programs to help owners calculate the benefits and costs of a project and a "seal of approval" for retrofitted buildings. The latter would be given following an inspection that confirms that the building meets certain standards. There are many other personal but noneconomic incentives to protect a property from flood damage, such as peace of mind and increased value at property resale.

Mandates: Mandates are considered a last resort if information and incentives aren't enough to convince a property owner to take protective actions. The substantial damage requirement is an example that requires a building to be elevated or otherwise brought up to current flood protection codes.

Another possible mandate is to require less expensive flood protection steps as a condition of a building permit. For example, many communities require upgraded electrical service as a condition of a home improvement project. If a person were to apply for a permit for electrical work, the community could require that the service box be moved above flood level.

6.7. Conclusions

1. There are a variety of flood protection measures that can be implemented to protect individual buildings from flooding:

   – Given the available funding, acquisition is most appropriate for buildings that were substantially damaged.
   – Elevation is appropriate for buildings on crawlspaces. Financial assistance is available from several disaster assistance programs.
   – Wet floodproofing is appropriate for buildings on crawlspaces.
   – Barriers and dry floodproofing are appropriate for buildings on slab subject to shallow flooding.

2. Many floodproofing measures can be installed by the owner or by a contractor at relatively little cost to the owner.

3. The City Shop access road and the sewer lift stations would benefit from property protection measures.

4. There should be more buildings with flood insurance coverage, although this may change after more people are made aware of the benefits of insurance and/or may be required to carry it as a condition of disaster assistance.

5. There are a variety of ways the City can assist property owners implement protection measures, ranging from disseminating information to helping fund the design and construction.

6.8. Recommendations

1. The City should proceed with the *Interim Report's* recommendations to acquire up to 19 substantially damaged buildings and floodproof the sewer lift and pump stations.

2. The City should investigate the costs and impacts of raising the City Shops access road.

3. The City should initiate a public information program to help people protect themselves. This is covered in more detail in Chapter 9.

4. The City should publicize possible sources of funds to help finance voluntary flood-proofing.

5. Other incentives to assist and promote self-help property protection measures should be explored.

6. Six months after the flood, the City should review the status of flood insurance coverage to determine if steps should be taken to increase it.

[This page intentionally blank.]

Chapter 7. Natural Resource Protection

Preserving or restoring natural areas or the natural functions of floodplain and watershed areas produce flood loss reduction benefits as well as improve water quality and habitats. These activities are usually implemented by parks, recreation, or conservation agencies or organizations. In addition to the four measures listed here, other measures, such as zoning and preservation of open space (covered in Chapter 5) can also protect natural resources.

7.1 Wetland protection
7.2 Erosion and sediment control
7.3 Best management practices
7.4 Dumping regulations

Conway already has an attitude that supports protecting the City's natural resources. Historically, citizens have wanted to protect significant trees throughout the community. Since the 1980s, the City has protected the following trees through two ordinances: live oak, flowering dogwood, redbud, American holly and magnolia. If this attitude were extended to wetlands and natural floodplain areas, much floodprone land would be protected from inappropriate development.

7.1. Wetlands protection

Wetlands are often found in floodplains or depressional areas in the watershed. Many can store large amounts of floodwaters, slowing and reducing downstream flows. They also filter water and provide habitats for fish and wildlife.

Wetlands

- Store large amounts of floodwaters
- Reduce flood velocities and erosion
- Filter water, making it cleaner for those downstream
- Provide habitat for species that cannot live or breed anywhere else

Most development projects in wetlands are regulated by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act. Corps "404" permits are required for projects that will place fill or dredged materials in a wetland. Before a permit is issued, the plans are reviewed by several agencies, including the U.S. Fish and Wildlife Service and the U.S. Environmental Protection Agency. The Natural Resources Conservation Service is responsible for identifying wetlands on agricultural lands.

Generally, these agencies want to protect wetlands by preventing development that will adversely affect them. However, sometimes the negative impact can be mitigated by preserving or developing an equivalent or larger wetland on another site, although it takes many years for a new wetland to approach the same quality as an existing one. Another drawback is that a new wetland in a different location (especially if it's in a different drainage basin) will not have the same flood protection benefits as the original one did.

Implementation in Conway: According to the South Carolina Land Resources Commission, approximately 45% of all land in Horry County is considered to be wetlands. This percentage is slightly higher in the Conway area. This represents a tremendous resource that can provide flood protection as well as be inappropriate land for development.

Carolina Bays

Horry County also has over 300 Carolina bays, an unexplained phenomenon of the landscape of North and South Carolina. The elliptical or oval depressions characteristic of the Carolina bays usually fill with rainwater during winter and spring and dry during the summer months. When left in an unaltered condition, these bays are generally considered to be some type of temporary, isolated freshwater wetland. The bays provide many of the values associated with wetlands, including stormwater storage, water quality enhancement through biological processes, and habitat for many wildlife and plant species. Each bay may range in size from less than one acre to more than 1,000 acres. The Waccamaw River is the only river in the world to originate in and be fed by a Carolina bay. Fortunately, the state protects a large portion of these bays as State Heritage Preserves.
– Horry County Comprehensive Plan, page III-11.

In 1998, a court ruling limited the Corps of Engineers' permit authority to wetlands that are within 800 feet of navigable streams, i.e., the Waccamaw River. DHEC and DNR review and comment on development plans before the Corps issues a 404 permit.

The state agencies have no authority to veto or alter a proposed permit. However, there are good relations and cooperation with the Corps' program and state recommendations are often accepted.

In the coastal counties, development in the remaining wetlands is subject to review by DHEC's Office of Ocean and Coastal Resources Management (OCRM). As with the Corps' program, OCRM does not stop development. It can only minimize the adverse impact development has on a wetland.

An alternative wetland protection measure is to purchase the land or otherwise pay the owner to prevent development on it. Since 1996, over 10,000 acres of wetlands have been enrolled in the state-wide Wetland Reserve Program. In most of the successful projects, additional agencies and private partners are part of the cooperative effort. Examples of partners could be: State Department of Natural Resources, U.S. Fish and Wildlife Service, or the South Carolina Waterfowl Association.

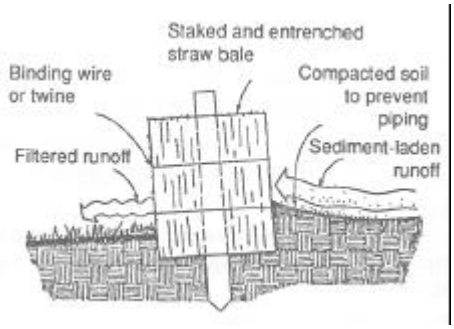
7.2. Erosion and sediment control

Because farmland and construction sites are usually bare, stormwater runoff can erode soil, sending sediment into downstream waterways. Sediment tends to settle where the river slows down, such as when it enters a lake.

Sedimentation will gradually fill in channels and lakes, reducing their ability to carry or store floodwaters. Not only are the drainage channels less able to do their job, but the sediment in the water reduces light, oxygen and water quality which affects water supply treatment, habitat and fishing.

Practices to reduce erosion and sedimentation on farms and construction sites have two principal components: minimize erosion and capture sediment before it leaves the site. Slowing runoff on the way to a drainage channel increases infiltration into the soil and controls the loss of topsoil from erosion and the resulting sedimentation. Runoff can be slowed down by measures such as vegetation, terraces, contour strip farming, no-till farm practices, basins and impoundments.

Straw bales catch sediment



The Sediment and Erosion Control Act of 1991 sets erosion and sediment control requirements for all construction projects greater than two acres. It is administered by DHEC, but communities can implement their own regulations if their standards meet or exceed DHEC's. As it excludes agriculture and forestry, its primary impact is on new construction sites.

Implementation in Conway: The City relies on the DHEC regulations and its regulatory standards for erosion and sediment control on construction projects. These are explained in *South Carolina Stormwater Management and Sediment Control Handbook for Land Disturbance Activities*, August 1998. The City does ensure that the proper DHEC permits are obtained.

7.3. Best management practices

Point source pollutants come from clearly identified locations such as the outfall of a municipal wastewater treatment plant. Nonpoint source pollutants come from non-specific locations. Examples of nonpoint source pollutants are lawn fertilizers, pesticides, and other farm chemicals, animal wastes, oils from street surfaces and industrial areas and sediment from agriculture, construction, mining and forestry.

Best management practices ("BMPs") are measures that reduce nonpoint source pollutants that enter the waterways. Unlike erosion and sediment controls which focus on problems created during construction, BMPs can also be implemented as part of a project's design to permanently address nonpoint source pollutants.

There are two general categories of BMPs:

1. Those that prevent runoff that conveys sediment and other water-borne pollutants, such as planting proper vegetation and conservation tillage, and

2. Those that stop pollutants after they are en route to a stream, such as grass drainageways that filter the water and retention and detention basins that let pollutants settle to the bottom before they are drained.

In addition to improving water quality, BMPs can have flood related benefits. By managing runoff, they can attenuate flows and reduce the peaks after a storm. Combining water quality and water quantity measures can result in more efficient multi-purpose stormwater facilities.

Because of the need to clean up our rivers and lakes, there are several state and Federal laws mandating the use of best management practices for new developments and various land uses. Specific BMPs and structural measures may be required on industrial sites, mined lands, construction sites, farms, forested areas, and high use public lands.

BMPs are required on construction and mining sites as described in the previous section on erosion and sediment control. Otherwise, mandates are limited to communities subject to the U.S. EPA's National Pollutant Discharge Elimination System (NPDES) requirements.

The U.S. Natural Resources Conservation Service (NRCS), soil and water conservation districts and the Department of Natural Resources provide advice and encouragement to farmers and other landowners. The NRCS can now tie USDA financial aid programs for farmers to their willingness to incorporate BMPs in their farming techniques. Elsewhere, getting property owners and developers to incorporate BMPs in their practices is primarily an educational effort.

The DNR's Stewardship Development Program provides technical assistance to those involved in the land development process on how to lessen the impact of the project on the natural environment. The program is preparing a handbook describing the stewardship design process and various conservation concepts. Floodplain protection is a consideration in the program's technical assistance aspects and is a topic in the proposed guidelines anticipated in 1999.

Implementation in Conway: Because of the livestock raised along the floodplain of the Waccamaw River, the 1999 flood waters were contaminated with hog waste and other contaminated sediment. "The human waste from overflowing sewers and septic tanks, along with the chemicals from roads, farms and lawns added to the contamination. Exposure to these contaminated waters made it necessary for residents and rescuers to get tetanus and hepatitis shots to prevent the spread of disease.

Farming for Clean Water in South Carolina, page 40

A recent Department of Natural Resources' publication, *Farming for Clean Water in South Carolina* provides recommended BMPs for agricultural areas. It promotes waste management plans as a way farmers can better manage animal wastes by recycling valuable nutrients. By this approach, property owners can protect water quality by saving money

Implementing BMPs in areas outside the corporate limits is beyond the City's jurisdiction. However, the City can work with the County, Department of Agriculture agencies and others to encourage property owners in North and South Carolina to follow the

recommendations in *Farming for Clean Water.*

7.4. Dumping regulations

Floodplain regulations and building codes control major development projects. However, debris can be accidentally or intentionally dumped into the channels or wetlands, obstructing even low flows and reducing their ability to retain or clean stormwater.

Dumping regulations are one approach to preventing intentional placement of trash or debris in channels and other water bodies. Many cities have nuisance ordinances that prohibit dumping garbage or other "objectionable waste" on public or private property. Some prohibit the discharge of polluted waters into natural outlets or storm sewers. Waterway dumping regulations need to also apply to "nonobjectionable" materials, such as grass clippings or tree branches which can kill ground cover or cause obstructions in channels.

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard not realizing that it is needed to drain street runoff. Similarly, they may not understand how regrading their yard, or discarding leaves or branches in a watercourse can cause a problem. Therefore, a dumping enforcement program should include public information materials that explain the reasons for the rules as well as the penalties.

Regular inspections to catch violations also should be scheduled. Finding dumped materials is easy; locating the source of the refuse is hard. Usually the owner of property adjacent to a stream is responsible for keeping the stream clean. This may not be fair for sites near bridges and other public access points.

Implementation in Conway: Section 3 - 1 - 23 of the City's Code of Ordinances specifies the City's authority to prevent obstructions to drainage and the penalty for violations. The ordinance clearly regulates drainage in streets and makes the City responsible for maintaining open ditches. The ordinance is enforced by the Department of Public Works.

7.5. Conclusions

1. Much of Conway's watershed is comprised of wetlands. Protecting these areas and preserving them as open space can help reduce flood losses.

2. Conway has some regulations for protecting natural resources and water quality, but their effectiveness is limited to development within the corporate limits.

3. A flood protection program can take advantage of interest protecting wetlands and natural features and utilize natural resource protection programs to support flood protection.

7.6. Recommendations

1. The City should review its regulatory requirements for new development in wetlands and other natural areas to see if best management practices should be included. Development regulations should promote and reward developments that protect natural areas.

2. The City should work with County and State officials to monitor and encourage Best Management Practices for farming upstream.

3. The City should incorporate preserving natural areas in its work to preserve open space (see Chapter 5's recommendations) and should utilize interest in and programs that protect natural areas to support the corridor plan.

4. The City should include protecting natural resources in its public information programs.

Chapter 8. Emergency Management

Emergency management measures protect people during and after a flood. Most counties and many cities have emergency management offices to coordinate warning, response and recovery during a disaster. Three distinct flood-related emergency management measures follow in chronological order:

8.1 Flood threat recognition
8.2 Flood response
8.3 Post-disaster recovery and mitigation

8.1. Flood threat recognition

The first step in responding to a flood is knowing that one is coming. A flood threat recognition system provides early warning to emergency managers. A complete system measures rainfall, snow conditions, soil moisture, and stream flows upstream in order to calculate the time and height of the flood crest downstream.

On larger rivers, the flood threat recognition work is done by the National Weather Service (NWS). The NWS can access river gages to develop real time flood threat data. Based on the data it collects, the Weather Service issues River Flood Watches and River Flood Warnings with the estimated time and height of the flooding at gage locations throughout the State. River Flood Warnings are issued when the stage is forecasted to reach flood stage within 24 hours. River Flood Watches are issued if the river will reach flood stage after 24 hours.

On smaller streams without forecast points, the Weather Service issues Flash Flood Watches and Warnings when flooding is expected within 6 hours after the heavy rains begin. Communities on these smaller streams that want specific flood threat data must develop their own systems. They may install rain and river gauges in key locations, then gather data from them electronically or manually.

Implementation in Conway: The Weather Service provides watches and warnings for the Waccamaw River based on the gage data. In addition to disseminating the data through NWS and emergency management channels, the gage predictions are posted on the gage's web site. The Horry County Division of Emergency Preparedness utilizes this information to prepare for the expected flood.

On the smaller rivers, including Crabtree and Kingston Lake Swamps, there are no reporting gages or specific flood threat statements with predicted times and flood heights.

The Weather Service data relate to "flood stage," i.e., the height where floodwaters will start to cause property damage. As discussed in Chapter 2, stages are numbers that vary from gage to gage and the stages at various gages are not related to each other. The shortcomings of the use of gage stage level is also covered in Chapter 2.

8.2. Flood response

Once a flood threat is recognized, the first priority is to notify the public and staff in other agencies and critical facilities that a flood is imminent. The earlier and the more accurate the warning, the greater the number of people who can take protection measures.

A flood warning may be disseminated in a variety of ways, including via NOAA Weather Radio, sirens, radio, television, cable TV, mobile public address systems, telephone trees, and even door-to-door contact. Multiple or redundant systems are most effective: if people do not hear one warning, they may still get the message from another part of the system.

The second priority is to respond with actions that can prevent or reduce damage or injury. Such actions could include:

- Sandbagging certain areas
- Closing streets or bridges
- Shutting off power to threatened areas
- Releasing children from school
- Opening evacuation shelters
- Monitoring water levels

The third priority is to prevent dangers to health and safety after the flood. The flood response plan should identify appropriate measures to take and which agencies will be responsible for carrying them out. These include:

- Patrolling evacuated areas to prevent looting
- Providing safe drinking water
- Vaccinating residents for tetanus and similar diseases
- Clearing streets
- Cleaning up debris and garbage
- Evaluating damaged buildings to determine if they can be reentered

A flood response or emergency action plan is the best way to ensure that all bases are covered and that the response activities are appropriate for the expected flood threat. It is developed in coordination with the agencies or offices that are given various responsibilities.

Implementation in Conway: Managing flood response is the responsibility of the Horry County Division of Emergency Preparedness. When a flood is imminent, a County flood task force is convened. Conway's City Administrator is a member and several department heads participate. Led by the County's Emergency Manager, the task force determines what needs to be done and tasks local, state and federal agencies with assignments or requests. For example, the first assignment during the 1999 flood was a request to the Corps of Engineers for flood fighting experts.

There is a written standard operating procedure on emergency flood actions that need to be followed for public safety concerns. There is no specific flood annex or plan that gears flood response activities to predicted flood stages. Given the slow rising and falling flood waters and the excellent cooperation between the flood task force, the current system has worked very well.

Horry County's system does include a meeting of the flood task force after the disaster to prepare an after action report. The meeting is tentatively planned for early in the year 2000.

8.3. Post-disaster recovery and mitigation

After a disaster, communities should undertake activities that can prepare people and property for the next one. They are implemented during recovery to keep people from immediately going "back to normal" (i.e., the same way they were before the disaster). These measures include:

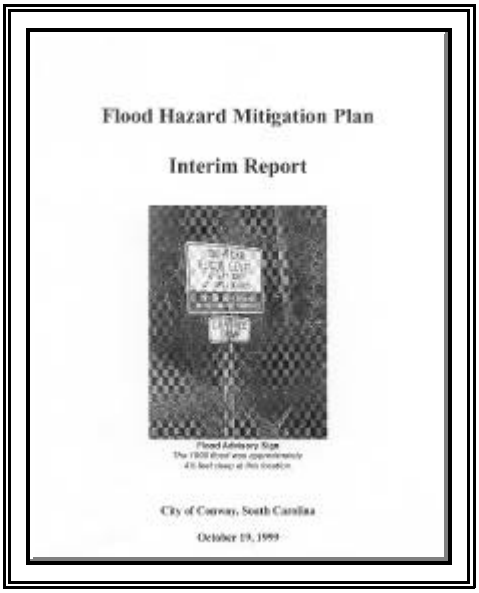
- Regulating reconstruction to ensure that it meets all code requirements, including the NFIP's substantial damage regulations
- Public information to advise residents about mitigation measures they can incorporate into their reconstruction work
- Evaluating damaged public facilities to identify mitigation measures that can be included during repairs
- Acquiring substantially or repeatedly damaged properties from willing sellers
- Planning for long term mitigation activities
- Applying for post-disaster mitigation funds

Requiring permits, making inspections and enforcing the substantial damage regulations can be very difficult on local, partially-trained and understaffed offices after a disaster. If not done right, not only does a community miss a tremendous opportunity to redevelop or clear out a hazardous area, it may be violating its obligations to the NFIP.

Implementation in Conway: As explained in the methodology section of Chapter 1, after the 1999 flood, Conway implemented a flood recovery and mitigation planning effort. This work included careful enforcement of the reconstruction regulations, two public meetings, news releases and an evaluation of each of the 100+ flooded buildings.

Several handouts to explain various aspects of the City's recovery and mitigation activities were published and disseminated:

- *Repairing Flooded Buildings*
- *Advice to Flooded Property Owners*
- *Mitigation Financial Assistance*
- *Elevating and Relocating a House*



Within three weeks, a *Flood Hazard Mitigation Plan – Interim Report* was drafted and subsequently adopted by the City Council. It laid out the short term mitigation recommendations and identified appropriate sources of financial assistance. This *Flood Hazard Mitigation Plan* is the culmination of this effort.

The City also attended sessions on disaster assistance and mitigation funding programs. It applied for over $1 million in mitigation grants for acquisition and sewer lift station protection.

8.4. Conclusions

1. Flood stage and time predictions are available for the Waccamaw River at the Conway gage. However, to be useful, the gage stages need to be related to mean sea level (NGVD).

2. Conway and Horry County successfully responded to recent floods. Shortcomings in the current response system should be identified and corrected during preparation of the after action report.

3. Conway implemented a post-disaster mitigation effort, but it is not a routine operation.

8.5. Recommendations

1. The Department of Natural Resources, U.S. Geological Survey and National Weather Service should convert all river gages to a consistent system based on sea level.

2. Public information programs should explain flood watches and warnings and appropriate safety and protection steps to take after they are issued.

3. The City should actively participate in the County's after action report.

4. The City should keep all records and handouts from this post-flood recovery and mitigation effort to guide City activities after the next flood.

5. The City and the County's after action report should consider formalizing post-disaster reconstruction regulation and mitigation planning procedures in their flood and/or disaster response plans.

Chapter 9. Public Information

Public information activities advise property owners, potential property owners and visitors about the hazards, ways to protect people and property from the hazards, and the natural and beneficial functions of floodplains. They are usually implemented by a public information office.

Public information measures can include:

9.1	Map information	9.4	Library
9.2	Outreach projects	9.5	Technical assistance
9.3	Real estate disclosure	9.6	Educational programs

9.1. Map information

There are many benefits to providing map information to the public. Residents and businesses who are aware of the potential flood hazard can take steps to avoid problems and/or reduce their existing exposure to flooding. Real estate agents and house hunters can find out if a property is floodprone and whether flood insurance may be required.

Communities are the best source of map information because they can often supplement what is shown on the Flood Insurance Rate Map (FIRM) with maps that complement and clarify the FIRM and information on additional hazards, flooding outside mapped areas and zoning. When the information is provided, community staff could also explain flood insurance, property protection measures and mitigation options that are available to property owners.

Flood maps have a wealth of information about past and potential flood hazards. However, they can be hard to obtain and many people have trouble reading maps. Therefore, communities that provide map or FIRM information provide a valuable public information service which can be the first step to educating residents on how to protect themselves from flooding.

Implementation in Conway: Although the City has the most recent FIRM posted at City Hall, few residents have consulted the map. The Building Department does provide map information to inquirers, but does not advertise this service. This is preferred over letting people simply look at a FIRM, given the map's errors that are discussed in Chapter 2.

9.2. Outreach projects

Outreach projects are a proactive approach to public information. They educate individual residents about various topics and are designed to encourage people to seek more detailed information in order to take action to protect property. They can cover a variety of topics, such as the flood hazard, flood insurance, mitigation measures, flood warning procedures and local regulations.

There are many types of outreach projects. They can include:

- Mass mailings or newsletters to all residents
- Notices directed to floodplain residents
- Displays in public buildings, shopping malls, etc.
- Displays or special sales in home improvement stores
- Newspaper articles and special sections
- Radio and TV news releases and interview shows
- A floodproofing video for cable TV programs or to loan to organizations
- A detailed property owner handbook tailored for local conditions
- Presentations at meetings of neighborhood groups
- Internet web sites

Research has proven that outreach projects work. Not only do they educate residents, but local decisions makers become more aware of the hazards and ways to reduce their impact.

However, awareness of the hazard is not enough; people need to be told what they can do about it, so outreach projects should include information on property protection measures. Research has also shown that a properly run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

Implementation in Conway: While the City has several public information activities, it has not implemented any directed toward flooding or hazard mitigation. It does not have a regular newsletter to residents, but does utilize news releases and the cable television channel for messages.

Horry County's Division of Emergency Preparedness has published a brochure, *Hurricane Preparedness – Are You Ready?* This provides detailed instructions to residents on preparedness, evacuation, re-entry and repairs.

9.3. Real estate disclosure

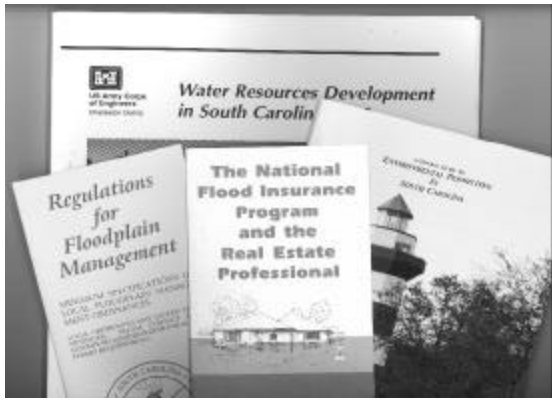
Many times after a flood, people say they would have taken steps to protect themselves if only they had known they had purchased a floodprone property. Federally regulated lending institutions must advise mortgage or other loan applicants that the property is in a floodplain as shown on the Flood Insurance Rate Map. Because this requirement has to be met only ten days before closing, often the applicant is already committed to purchasing the property when he or she first learns of the flood hazard.

State laws and practices by local real estate boards can overcome this deficiency and advise newcomers about the hazard earlier. They may also require disclosure of past flooding or sewer problems, regardless of whether the property is in a mapped floodplain.

Implementation in Conway: South Carolina has no state laws that require disclosure of whether a property is in a floodplain. The Department of Natural Resources has published a brochure, "The National Flood Insurance Program and the Real Estate Professional," which explains why real estate agents should determine and disclose whether a property is in a mapped floodplain. It notes that such disclosure will help the buyer get a mortgage, understand local regulations, and be aware of restrictions on disaster assistance and the cost of flood insurance premiums.

As a general practice, Horry County real estate firms do not determine if a property is in a mapped floodplain and the multiple listing service does not have a spot for such information. Some firms do ask sellers if there has been a history of flooding, but there is no formal form that an owner signs listing a property's history or problems.

9.4. Library



The community library is an obvious place for residents to seek information on flooding, flood protection and protecting natural resources. Libraries are usually the first place people turn to when they want to research a topic.

Libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the municipal or county government.

Implementation in Conway: The Horry County Library in Conway has one flood related reference: the outdated Flood Insurance Study for the County. The Reference Desk would utilize references that help people protect themselves from flooding.

9.5. Technical Assistance

Property owners usually implement their own property protection measures. However, measures to encourage and assist owners can be implemented at the community level.

Technical assistance can be provided in one-on-one sessions with property owners. Community officials can provide advice and information on matters such as identifying flood hazards at the site, correcting local drainage problems, floodproofing, dealing with contractors, and funding. The Department of Natural Resources, the Natural Resource Conservation Service and the county soil and water conservation districts can help local technical assistance programs.

One effective technique is called a *flood audit*. A knowledgeable person visits a floodprone site, locates flood depths on the property, and discusses alternative protection measures with the owner. The owner is given a written report with recommendations and a picture of the property showing predicted flood depths.

Implementation in Conway: The Building Department has given and can give advice to inquirers on flood protection measures appropriate for the inquirer's situation. The office can also provide the names of contractors licensed to do the work. This service has not been advertised.

9.6. Educational programs

A community's most important asset is its children, the future generations who will inherit the resources, infrastructure and development left to them. They will be facing the same natural forces that cause periodic flooding. The watersheds and floodplains will be theirs to farm, build on and care for.

Environmental education programs can teach children about flooding, the forces that cause it, the factors that cause flood problems, and the significance of protecting the natural and beneficial functions of watersheds and floodplains. These programs can be undertaken by schools, park and recreation departments, conservation associations, and youth organizations, such as the Boy Scouts, Campfire Girls and summer camps. An activity can be as involved as course curriculum development or as simple as an explanatory sign near a river or on the beach.

> In Sumter, South Carolina, high school students assisted the Natural Resource Conservation Service to restore a wetlands through the Wetlands Reserve Program. This helped to fund a school program to plan, restore and monitor wetlands, providing an outdoor classroom for the students.

Education programs do not have to be limited to children. Often adults learn about innovative concepts or new ideas from their children. If the children come home with an assignment for their new water quality monitoring project, then the parents are suddenly very interested in finding out about water quality monitoring.

Implementation in Conway: The South Carolina Department of Education is adopting an impressive and extensive set of state standards for local curricula. It begins in kindergarten with basic concepts of the water cycle and water conservation and goes through 10th grade. Topics include flooding, severe weather safety, landforms, identifying drainage divides, and "living in areas with natural hazards."

Horry County school teachers will be incorporating these topics into their learning plans over the next year or two. Teachers also have access to the Blackwater Swamp Environmental Center. Owned by a private foundation, public and private schools use the Center for site visits and science projects relating to wetlands and water quality.

9.7. Conclusions

1. There are many ways that public information programs can be used so that people and businesses will be more aware of the hazards they face and how they can protect themselves.

2. Some of the public information activities are best done on a regional or county level, such as real estate disclosure and developing school curricula.

3. Some of the public information activities can be prepared and implemented by the City and be tailored to meet local needs.

4. There are many opportunities to coordinate information programs with the educational activities in the schools.

9.8. Recommendations

1. Public information activities should cover the following flood protection topics.

   – Causes and extent of flooding
   – What is being done about flooding
   – What to do during a flood
   – How people can protect their homes
   – Flood insurance
   – Taking care of drainageways
   – Status of implementing this *Mitigation Plan*

2. The City should implement and publicize the following services that will inform and assist property owners who want to protect themselves from flooding.

   – Providing map and flood hazard data to inquirers
   – Making site visits to review problems and providing advice to the owner

- Providing the library and other offices with a list of appropriate flood protection references, government publications, Internet web sites and maps. The list would include ordering or contact information for each item.

3. The following projects should be implemented to disseminate the messages on flood hazard mitigation and City services.

   - A periodic newsletter for all residents impacted by flooding should be initiated. The newsletter would provide updates on implementing this *Mitigation Plan*, announce upcoming events, and celebrate successful mitigation projects.

   - News releases and news articles on flood protection measures and the progress of implementing this *Mitigation Plan* should be prepared for the local daily and weekly newspapers at least once every quarter.

   - A homeowner's flood protection manual should be prepared, made available for interested residents and businesses and given to other media that want to cover flood protection.

4. Meetings with selected groups, including schools and teachers, should be held so their members will become familiar with flooding, flood protection measures, natural floodplain and wetland functions, and City services.

5. The City should meet with the Horry County Association of Realtors® to discuss possible changes in practice to disclose floodplain zones when house hunters view a property.

Chapter 10. Action Plan

The culmination of this *Flood Hazard Mitigation Plan* is this last chapter. The first section on action items assigns recommended projects and deadlines to the appropriate City offices. At the end of the section is a summary of the action items in chronological order with the expected budget showing that most of the items can be accomplished with staff time or minimal operating expenditures.

A plan is worthless if there is no instrument for ensuring that it is carried out. Accordingly, a Mitigation Committee is recommended to monitor the implementation of the *Plan*, for reporting to the City Council on its progress and to recommend revisions to this *Plan* as needed. The Mitigation Committee is explained in section 10.2. The last section has the proposed City Council resolution to put the Action Plan in effect.

10.1. Action items

This Action Plan organizes the recommendations according to the office that would be responsible for them. For each action item, the action plan identifies:

- The goal(s) and objective(s) from Chapter 3 that the action item supports.

- The recommendation(s) in Chapters 4 - 9 that are being implemented. For example, "*Recommendation reference:* 6.8.3" means that this recommendation can be found in Chapter 6, section 6.8.3. These references provide more background and direction on the action items.

- The deadline for the action item to be completed. Several are listed for August 31, in time for the recommended annual evaluation report due to the City Council by September 15.

The first three action items are administrative measures related to the overall mitigation program rather than to specific goals, objectives or recommendations.

City Council

1. Adopt the *Flood Hazard Mitigation Plan* by passing the resolution in section 10.3.

   Deadline: January 31, 2000.

2. Create the Mitigation Committee and appoint its members.

   Deadline: January 31, 2000. The Committee is created by passage of the resolution in section 10.3. The Mayor should appoint its members at the time the resolution is passed.

3. Monitor implementation of the Action Plan and report on progress and recommended changes to the City Council each year.

   Deadline: Reports should be submitted by September 15 each year. The September 15 timing coincides with the plan evaluation report that must be submitted by October 1 for Community Rating System (CRS) credit.

4. Invite representatives of the Horry County Department of Public Works, the Natural Resources Conservation Service, the Crabtree Watershed Conservation District and local engineering firms to meet with the Committee to review the costs and benefits of preparing a drainage system capital improvements plan and/or joining the County's stormwater utility.

   Supporting goal(s) and objective(s): Goal 1, objective 4
   Goal 2, objective 3
   Goal 3, objective 2

   Recommendation reference: 4.7.3, 4.7.5, 4.7.6

   Deadline: August 31, 2000

5. Review alternatives ways to encourage residents to implement property protection measures (including purchasing flood insurance) and develop appropriate programs to motivate such self-help activities.

   Supporting goal(s) and objective(s): Goal 1, objective 2
   Goal 3, objective 3

   Recommendation reference: 6.8.3, 6.8.4, 6.8.5, 6.8.6

   Deadline: August 31, 2000

6. Invite representatives of appropriate organizations and agencies to meet with the Committee to further coordination, cooperation and implementation of projects that depend on people who are outside Conway's City government. These include:

   – The Natural Resources Conservation Service and farm organizations to discuss best management practices for hog farms in the watershed.

   – Conservation and recreation organizations to discuss building a coalition in support of open space preservation and a greenway along the rivers.

   – School curriculum staff and teachers to discuss incorporating flood hazard mitigation measures in school lessons.

   – The Horry County Association of Realtors® to discuss disclosing floodplain zones when house hunters view a property.

– Associations of homeowners or businesses to discuss how to best motivate their members to implement property protection measures, including purchasing flood insurance.

Supporting goal(s) and objective(s): Goal 3, objectives 1, 2, 3, 4 and 5

Recommendation reference: 5.10.4, 6.8.3, 6.8.4, 6.8.5, 6.8.6, 7.6.2, 7.6.3, 9.8.4, 9.8.5

Deadline: First meeting by May 31, 2000, all meetings by August 31, 2001

City Administrator

7. Apply to the Community Rating System.

   Supporting goal(s) and objective(s): All

   Deadline: July 31, 2000. Although not an official CRS deadline, applications should be submitted by January 31 (for the October 1 CRS effective date) and July 31 (for the April 1 effective date of the following year).

8. Participate in the efforts of the County Division of Emergency Preparedness to critique, improve and formalize the County's flood warning, response, recovery and mitigation efforts.

   Supporting goal(s) and objective(s): Goal 1, objectives 2 and 3
   Goal 3, objective 2

   Recommendation reference: 8.5.3, 8.5.4, 8.5.5

   Deadline: Ongoing

Grants/Special Projects Coordinator

9. Submit the documents necessary to request a review of flood control alternatives on Crabtree Swamp and the Waccamaw River to the Natural Resources Conservation Service and the U.S. Army Corps of Engineers, respectively. Monitor the agencies' progress and seek political support when needed.

   Supporting goal(s) and objective(s): Goal 1, objectives 2 and 3
   Goal 3, objective 1

   Recommendation reference: 4.7.1, 4.7.2

   Deadline: February 28, 2000

10. Submit the documents necessary to obtain funding for the acquisition of the substantially damaged buildings and floodproofing the sewer lift and pump stations. If funds appear to be available, include a request for funding of the purchase of the vacant land adjacent to the acquisition area.

Supporting goal(s) and objective(s): Goal 1, objectives 1 and 3
Goal 3, objective 1

Recommendation reference: 6.8.1

Deadline: March 15, 2000

Director of Planning

11. Prepare an open space/greenway concept plan for the vacant areas along Crabtree Swamp, Kingston Lake Swamp and the Waccamaw River, including a reuse plan for the substantially damaged building sites to be acquired by the City. The concept plan would identify a likely corridor for a trail and appropriate implementation methods, including acquisition, sources of funding, donation and regulatory approaches. The plan should identify other agencies' and programs' funds and encourage cooperative efforts on the part of the landowners.

    Supporting goal(s) and objective(s): Goal 1, objective 1
    Goal 2, objective 2
    Goal 3, objectives 1, 2, 4 and 5

    Recommendation reference: 5.10.4, 6.8.1, 7.6.1, 7.6.3

    Deadline: August 31, 2000

12. Conduct a review of the land use plan, zoning ordinance, subdivision and stormwater management regulations to identify changes that would make them more effective in preventing flooding and drainage problems and that would prevent inappropriate development in areas subject to flooding or having natural and beneficial functions. Review the possible changes with the Mitigation Committee and the appropriate City review board.

    Supporting goal(s) and objective(s): Goal 2, objectives 1, 2 and 3
    Goal 3, objectives 4 and 5

    Recommendation reference: 5.10.5, 5.10.7, 7.6.1, 7.6.3,

    Deadline: August 31, 2001

Building Official

13. Conduct a review of the floodplain regulation ordinance to identify changes that would make it clearer to understand, easier to enforce, and consistent with the recommendations of this *Plan*. Consider possible credits under the Community Rating System. Review the possible changes with the Mitigation Committee and the appropriate City review board.
    Supporting goal(s) and objective(s): Goal 2, objective 1

    Recommendation reference: 5.10.6

    Deadline: August 31, 2000

14. Formalize and publicize providing map and flood hazard data and flood protection advice to inquirers. These services should be provided and documented so as to receive CRS credit.

    Supporting goal(s) and objective(s): Goal 1, objective 2
    Goal 3, objective 3

    Recommendation reference: 9.8.2

    Deadline: June 30, 2000 (one month before action item 7's CRS application deadline)

Director of Public Works

15. Prepare formal procedures for a drainage system maintenance program. This work should be closely coordinated with the Crabtree Swamp Watershed Conservation District and should follow the guidelines of the Community Rating System. This program may be considered an interim measure until (and if) the City joins the County's stormwater utility program.

    Supporting goal(s) and objective(s): Goal 1, objective 4
    Goal 2, objective 3
    Goal 3, objective 2

    Recommendation reference: 4.7.4, 4.7.5

    Deadline: June 30, 2000 (one month before action item 7's CRS application deadline)

Public Information Officer

16. Develop and publish a periodic newsletter for floodplain residents. It should cover flood protection information and sources of assistance, update readers on what the City is doing about flooding, publicize City services, and report progress toward the acquisition program and the other action items in this *Plan*.

    Supporting goal(s) and objective(s): Goal 1, objective 2
    Goal 3, objectives 2, 3 and 5

    Recommendation reference: 4.7.5, 6.8.3, 6.8.4, 7.6.4, 8.5.2, 9.8.1, 9.8.2, 9.8.3

    Deadline: First issue by February 28, 2000

17. Draft and publish a 10 - 15 page homeowner's flood protection manual that would be provided free to any resident.
    Supporting goal(s) and objective(s): Goal 1, objective 2
    Goal 3, objectives 2, 3 and 5

    Recommendation reference: 4.7.5, 6.8.3, 6.8.4, 7.6.4, 8.5.2, 9.8.1, 9.8.2, 9.8.3

    Deadline: June 30, 2000 (one month before action item 7's CRS application deadline)

City Engineer

18. Prepare a profile of the 1999 flood crest elevations. Transfer the information to the best available ground elevation data to prepare a regulatory floodplain map for the City.

    Supporting goal(s) and objective(s): Goal 1, objective 2
    Goal 2, objectives 1 and 2
    Goal 3, objective 3

    Recommendation reference: 5.10.2, 5.10.3

    Deadline: March 31, 2000

19. Prepare a short report on the costs, benefits and flood impacts of raising the access road to the City Shops.

    Supporting goal(s) and objective(s): Goal 1, objective 3

    Recommendation reference: 6.8.2

    Deadline: March 31, 2000

Department of Natural Resources

The South Carolina Department of Natural Resources assists local mitigation programs and helped finance the preparation of this *Plan*. Therefore, although not a City office or contractor, it is being requested to implement two action items.

20. Have FEMA review the current Flood Insurance Study and Flood Insurance Rate Map in light of the 1999 flood and request a restudy as needed.

    Supporting goal(s) and objective(s): Goal 2, objectives 1 and 2

    Recommendation reference: 5.10.1

    Deadline: August 31, 2000

21. Get the reported stages for all the river gages in Horry County converted to elevations above mean sea level (NGVD).

    Supporting goal(s) and objective(s): Goal 1, objective 2
    Goal 3, objectives 1 and 3

    Recommendation reference: 8.5.1

    Deadline: August 31, 2000

Deadline	Action Item		Responsible Office	Budget
1/31/2000	1	Adopt the *Mitigation Plan*	City Council	Staff time
1/31/2000	2	Create the Mitigation Committee	City Council	Staff time
TBA	10	Request acquisition/sewer funding	Grants Coord.	Staff time
2/28/2000	9	Request flood control studies	Grants Coord.	Staff time
2/28/2000	16	Newsletter	Public Info Officer	Staff time + printing/mailing
3/31/2000	18	Profile of 1999 flood crest elevations	Engineer	$
3/31/2000	19	Report on raising access road	Engineer	$
5/31/2000	6	Meeting with various organizations	Committee	Staff time
6/30/2000	14	Provide map info and protection advice	Building	Staff time
6/30/2000	15	Drainage maintenance procedures	Public Works	Staff time
6/30/2000	17	Homeowner's flood protection manual	Public Info Officer	Staff time + printing
7/31/2000	7	Apply to Community Rating System	Administrator	Staff time
8/31/2000	4	Meet w/County on drainage plans	Committee	Staff time
8/31/2000	5	Develop ways to motivate self-help	Committee	Staff time
8/31/2000	11	Open space/greenway/reuse plan	Planning	Staff time
8/31/2000	13	Review Floodplain building regulations	Building	Staff time
8/31/2000	20	Review Flood Insurance Study/FIRM	SCDNR	Staff time
8/31/2000	21	River gages reporting in elevations	SCDNR	Staff time
9/15/year	3	Monitor plan and report progress	Committee	Staff time
Ongoing	8	Improve flood warning and response	Administrator	Staff time
8/31/2001	12	Review land use regulations	Planning	Staff time

Action item summary and budget (in chronological order)

10.2. Mitigation committee

Floods have often been compared to fires: communities that face these hazards adopt both preventive measures, such as building code standards, and emergency measures to respond to the hazard when it occurs. One important difference is that every city has a fire chief – one person who administers fire prevention and fire fighting activities – while no city has a flood chief.

This plan recommends that the City create a permanent body that would assume the role of the flood chief. The proposed Mitigation Committee would be the focal point for the City's flood mitigation activities, i.e., the action items recommended by this *Flood Hazard Mitigation Plan*.

The Committee would be created by passage of the resolution in the following section. It would be an official advisory board to the City Council. It would be composed of members of the public who have an interest in flooding and drainage problems and the City staff who work on those problems. Hopefully, much of the membership would be drawn from those who worked on this *Plan*.

The size of the Committee does not have to be fixed. If more people are interested and want to work on the issues, the Committee could be expanded to accommodate them.

The Chair of the Committee would be appointed by the Mayor. That person could be drawn from either the public members or the City staff. Both approaches have been used in other communities and they both can work.

Staff support would be provided to the Committee by the appropriate City staff members, as assigned by the City Administrator, in the same way that staff support was provided to prepare this *Plan*. Consultants may also provide support, provided the City Administrator approves their work loads.

The Committee would not have any powers over City staff or other committees or commissions. It would be purely an advisory body. Its primary duty is to collect information and report to the City Council on how well this *Plan* is being implemented. Other duties include reviewing mitigation proposals and hearing residents concerns about flood and drainage protection.

The Mitigation Committee would be, in effect, the City's flood conscience. The resolution charges it with seeing the *Plan* carried out and recommending changes that may be needed. While it has no formal powers, its work should act as a strong incentive for the offices responsible for the action items to do their jobs.

The Committee should meet at least quarterly during the first years. There will be plenty of activities to monitor and review. As more and more new initiatives evolve into routine tasks, the workload will reduce. The Committee should eventually tackle mitigation issues related to hurricanes, earthquakes and other hazards facing Conway. The resolution allows for this flexible approach.

10.3. Plan adoption resolution

The following draft resolution is recommended for adopting this *Flood Hazard Mitigation Plan* and establishing the Mitigation Committee.

Resolution No. _____

Whereas the City of Conway has been faced with overbank flooding and drainage problems over the years that have flooded buildings, closed businesses, disrupted traffic, and presented a general public health and safety hazard; and

Whereas the City's Mitigation Planning Committee has prepared a recommended *Flood Hazard Mitigation Plan* that reviews the City's options to reduce damage from flooding and drainage problems; and

Whereas the recommended *Flood Hazard Mitigation Plan* has been widely circulated for review by the City's residents, neighboring communities and federal, state and regional agencies and has been supported by those reviewers;

Now, therefore, be it resolved that:

1. The *Flood Hazard Mitigation Plan* is hereby adopted as an official plan of the City of Conway.

2. The Mitigation Committee is hereby established as a permanent advisory body.

    a. Committee members shall include:
        - The Building Official
        - The Director of Public Works
        - The Public Information Officer
        - The City Engineer
        - The Director of Planning
        - The Community Rating System Coordinator (if other than one of the above)
        - At least five residents
        - Other members as appropriate

    b. The Committee members and its Chair shall be appointed by the Mayor, subject to the approval of the City Council.

    c. Resident Committee members shall serve two year terms with one-half of the members' terms expiring each year.

    d. The schedule of Committee meetings shall be posted in appropriate places. All meetings of the Committee shall be open to the public.

    e. The Committee shall meet as often as necessary to prepare or review mitigation activities and progress toward implementing the *Flood Hazard Mitigation Plan*. It shall meet at least once each year to review the status of ongoing projects.

3. By September 15 each year, the Committee shall prepare an annual evaluation report to the City Council on the *Mitigation Plan.* The report will cover the following points:

   – A review of the original plan.

   – A review of any floods that occurred during the previous calendar year.

   – A review of the action items in the original plan, including how much was accomplished during the previous year.

   – A discussion of why any action items were not completed or why implementation is behind schedule.

   – Recommendations for new projects or revised action items. Such recommendations shall be subject to approval by this Council as amendments to the adopted plan.

4. The Committee should not restrict itself to only flood hazard mitigation. As time and interests become available, it should also investigate mitigation measures appropriate for hurricanes, earthquakes and other hazards facing Conway.

5. The City Administrator is charged with supervising the implementation of the plan's recommendations within the funding limitations provided by the City Council or other sources. The Administrator shall give priority attention to the following action items recommended by the *Flood Hazard Mitigation Plan*:

   – Submit applications for acquisition and sewer funding from State and FEMA mitigation programs (action item 10)
   – Request flood control studies from the U.S. Army Corps of Engineers and the Natural Resources Conservation Service (action item 9)
   – Review the costs and benefits of preparing a drainage system capital improvements plan and/or joining the County's stormwater utility (action item 4)
   – Start a newsletter for floodplain residents (action item 16)
   – Apply to the Community Rating System (action item 7)
   – Draft an open space/greenway/reuse concept plan (action item 11)

6. The City Administrator shall name a staff member as Community Rating System (CRS) Coordinator for the City. The CRS Coordinator shall be the main point of contact for all matters relating to the CRS. He or she is responsible for submittal of all documentation needed for the application, verification and annual recertification.

Passed this ___ day of January, 2000

Appendix A. Financial Assistance

A.1. Programs for individuals

Small Business Administration (SBA) loans

The maximum home loan amount is limited to $200,000 to repair or replace real estate and $40,000 to repair or replace personal property. If you had a prior SBA loan which required flood insurance and you have since dropped the insurance, SBA financing will not be available.

SBA will loan funds needed for projects that are required by the City's building code or floodplain ordinance, such as elevating your house.

There are three ways SBA funds relocation:

1. Mandatory relocation. If the resident is required by City code or ordinance to relocate, the amount of eligibility is the replacement cost of the property which must be abandoned. The maximum loan amount is $200,000.

2. Involuntary relocation. If a resident must relocate because of special or unusual situation beyond his control like a job transfer, medical or family reason, the amount of eligibility is the amount of the actual damage. Maximum loan amount is $200,000 for real estate replacement and $40,000 to repair/replace personal property. The actual amount of each loan, up to these maximums, is limited to the verified uninsured disaster loss.

3. Voluntary relocation. If a resident wants to relocate, the amount of eligibility is the amount of the actual damage. Maximum loan amount is $200,000 for real estate replacement and $40,000 to repair/replace personal property. The actual amount of each loan, up to these maximums, is limited to the verified uninsured disaster loss.

SBA can refinance all or part of prior mortgages if you

- do not have credit available elsewhere
- have received disaster damage of 40% or more of the value of the property, and
- intend to repair the damage.

Refinancing of prior debts can improve your ability to afford the SBA disaster loan.

Example: The City Building Official issues a letter stating that you must elevate the building because it was substantially damaged. You need $40,000 to repair your home and $25,000 to elevate it. If SBA says that the value of your house and your ability to repay qualifies, you can receive for a loan of up to $65,000 to do both repairs and elevation.

SBA 20% Mitigation Loans

An SBA loan may be increased by up to 20% for flood mitigation activities since the damage was caused by a flood. There does not need to be a City code requirement. All procedures are the same as for a regular SBA loan.

Example: You need $40,000 to repair your flooded house. If SBA says that the value of your house and your ability to repay qualifies, you can receive for a loan for $40,000 and an additional $8,000 (20% of $40,000) for mitigation projects, such as relocating your furnace and ductwork from the crawlspace to the attic.

Note: The 20% mitigation loan is figured as a percentage of your SBA loan. If you do not receive an SBA loan (e.g., all of your repairs are paid by your flood insurance claim), then there is no mitigation loan.

For more information: Call the disaster assistance toll-free number (800/462-9029). Complete an SBA application. Do not worry about the "credit available elsewhere" criteria. An SBA person will explain your situation directly.

SBA will verify the damage with an on-site visit. and a loan officer will contact you. At that time, you will need to tell the loan officer of your desire to relocate, elevate or undertake another mitigation project.

FEMA's Temporary Housing

Temporary housing is available to an owner of a damaged home for up to three months. A renter receives one month of temporary housing. An owner/non occupant cannot receive temporary housing. The total time available for housing can be extended up to 18 months. For example, if the resident is not allowed to reoccupy a substantially damaged home and is waiting for funding for elevation or acquisition.

For more information: Call the disaster assistance toll-free number (800/462-9029).

FEMA's Emergency Home Repairs

This program is part of Temporary Housing. It aims to get people back in their homes quickly rather than pay for housing elsewhere. It covers items deemed necessary for "habitability" of a residence (as defined by FEMA).

People who qualify can receive additional funds for mitigation items. These are not items identified by the owner or the FEMA inspector. They are identified by a computer program when the damage report is entered.

The additional funds can pay for things like:

- relocating the main electrical panel to a higher floor
- sewer drain plugs
- roof anchors and mobile home tie-downs
- elevating the furnace or water heater to 1 foot above the experienced flood elevation within the crawlspace or basement but not to another floor.

The resident will get a check for the eligible repairs including the additional mitigation funds. The amount of the additional funds is based on the cost of the identified mitigation activity in the Marshall and Swift estimating book. Separately, a letter is sent to the resident explaining that FEMA has included additional money to complete the specified mitigation activities.

An applicant may get money to clean or repair a damaged item. Later, if the item is found to be unrepairable, the applicant will have to complete an appeal process to receive the amount of replacing the item and possible mitigation.

For more information: Call the disaster assistance toll-free number (800/462-9029).

The National Flood Insurance Program's (NFIP) Increased Cost of Compliance (ICC)

Normally a flood insurance claim will just pay for repairs to the flooded building. ICC provides an additional payment to help pay for the cost to comply with State or community floodplain management laws or ordinances after a flood event. The building must have been declared substantially damaged or repetitively damaged.

ICC will help pay up to a maximum benefit of $15,000 for the cost to elevate, floodproof, demolish, or relocate the building. This is in addition to the building coverage for the repair of the actual flood damage covered by the standard flood insurance policy. However, the total claim for both ICC and repairs cannot be for more than the policy's coverage.

For more information: Contact your flood insurance agent or adjuster.

Private sources

The Southern Baptist, Jehovah Witnesses and other church groups have been active in the initial clean up phase in many homes. Occasionally, religious and other volunteer groups will also provide additional assistance including repairs and reconstruction. Caution must be used to make sure the best intentions are completed with the proper permits and don't circumvent the available mitigation opportunities.

For more information: Call the disaster assistance toll-free number (800/462-9029).

A.2. Programs for the City

SC DNR's Flood Mitigation Assistance (FMA)

The Flood Mitigation Assistance program (FMA) is a Federal Emergency Management Agency grant program administered by the Flood Mitigation Office of South Carolina's Department of Natural Resources. FMA is funded by the National Flood Insurance Program (NFIP) and its current focus is to remove as many repetitive loss properties as possible from future exposure to flood damage.

Any community in South Carolina that is participating in the NFIP and is good standing may apply for a FMA grant. FMA grants can cover up to 75% of the cost of an eligible activity. There are two types of grants:

1. Planning grants to develop a flood mitigation plan. This grant is paying part of the cost of Conway's post-Floyd flood mitigation plan.

2. Project grants for flood mitigation projects:

   - acquiring an insured building in the floodplain
   - relocating an insured building out of the floodplain
   - elevating an insured building above the base flood elevation
   - dry floodproofing an insured building (not if the project is a substantial improvement or repair of substantial damage to a residential building)
   - wet floodproofing (not if the project is a substantial improvement or repair of substantial damage)
   - establishing a program that provides technical or financial assistance program for the eligible protection measures listed above.

The community must have a flood mitigation plan to qualify for a project grant. The community must demonstrate that it has sufficient funding to cover the local share of the activity. If must be from a non-federal source such as municipal funds, Community Development Block Grant, or the property owner including up to 12.5% of the total cost may be in local in-kind services.

If a project is to protect a building:

- The community must have adopted an acceptable hazard mitigation plan.
- The project must be technically feasible and conform with local, state and federal regulations and executive orders.
- The project must have a benefit/cost ration of 1.0 or greater using the FEMA software.
- The building must be covered by a flood insurance policy.

The FMA cannot duplicated disaster assistance, flood insurance claim payments or other similar federal financial assistance. Federal assistance must be deducted from the project grant amount. The budget for this program is about $330,000 annually.

For more information: Contact Lisa Holland, Flood Mitigation Officer, South Carolina Department of Natural Resources at 803-734-9120.

FEMA's Hazard Mitigation Grant Program (HMGP)

The Hazard Mitigation Grant Program is often referred to as the Section 404 grant (from Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act). It assists States and communities in implementing long-term hazard mitigation measures following a major disaster declaration. The level of federal funds available for each disaster is 15% of the estimated FEMA disaster assistance expenditures for that disaster. The Hurricane Floyd disaster will generate an estimated $5 million for HMGP.

HMGP can be used to fund projects to protect either public or private property. Project examples include:

- structural measures such as levees and floodwalls
- elevation or floodproofing of structures
- acquisition and relocation of structures from the floodplain

The 25% non-federal share of the project can be from the Community Development Block Grant or other local or private source. It can be in the form of in-kind services or materials. It can be partially paid by the benefitting property owner. All projects must have a benefit cost ratio using the FEMA software.

The State's Interagency Coordinating Committee sets the priorities for HMGP. So far, it has been announced that priority should be given to Horry County, but the types of projects that will be given priority has not been decided.

The pre-application is due to EPD by November 15. EPD will announce which projects are selected by December 15. The City will then have to prepare the full application documentation.

For more information: Contact Todd Lewis, State Hazard Mitigation Officer, Emergency Preparedness Division, 803/714-5035 (Disaster Field Office).

FEMA's Section 406 Infrastructure Assistance

Section 406 is a funding source for cost-effective mitigation measures that would reduce or eliminate the threat of future flood damage to a public facility damaged during the disaster. The mitigation measures must apply only to the damaged elements of the facility. The hazard mitigation measures restore a facility beyond its predisaster condition.

A public assistance coordinator is assigned to each community. The Infrastructure assistance is 75% federal and 25% non-federal of the project's cost. An additional 15% of project cost can be added to the project's cost to mitigate a damaged element of a facility.

FEMA has determined that certain mitigation measures are cost-effective if they do not exceed 100% of project cost, are appropriate to the disaster damage, will prevent future damage, are

directly related to the eligible damaged elements and do not increase risk elsewhere. These projects include:

- replacement of damaged culverts and low span bridges that cause increased flooding upstream
- wet or dry floodproofing of wastewater treatment plant buildings
- dry floodproofing of damaged pump stations
- other public works mitigation measures listed in the predetermined list.

Mitigation activities that are over 15% of the project cost but are not on the predetermined mitigation measures list may be eligible. For these, the City must demonstrate through an acceptable benefit/cost analysis that the measures is cost-effective. There can be no duplication of funding between Section 404 and 406.

For more information: Contact the Disaster Field Office (803/714-5060)

Community Development Block Grant (CDBG)

The South Carolina Department of Commerce administer the Small Cities CDBG Program. The Small Cities Program gives maximum priority to activities which will benefit low and moderate income persons. Grants are available for a minimum of $50,000 for public facilities.

Each year the Department of Commerce establishes the programs that they will administer and funding is directed to those programs. Flood recovery and mitigation had not been identified as an identified program this year. The Department can redirect funds and often special funding is made available through the CDBG following a disaster. CDBG funded building elevation projects after Hurricane Hugo.

CDBG can be used as the nonfederal share of a project match.

For more information: Contact the Block Grant office at the Department of Commerce at 803/734-1399.

US Army Corps of Engineers Programs

The Corps of Engineers (COE) has several programs that are available to assist in flood rescue, recovery and mitigation. The City of Conway and Horry County requested and received Emergency Operations assistance which helped with the sandbagging of the lift stations in Conway.

The COE's Flood Plain Management Services Program can provide general technical assistance and planning guidance. This program can assist with flood data interpretation, flood preparedness studies, damage surveys, floodplain awareness workshops and more. In addition, the COE can provide floodproofing and regulations information.

The COE's Continuing Authorities Program - Flood Damage Reduction, Section 205, can be used to develop a flood protection project for an area. These projects have included levees, home

acquisition and elevation, and other mitigation activities with a benefit cost ratio of 1 or more. This program has a federal share limit of $5,000,000.

Each project goes through several steps, the first being a feasibility study. The COE may undertake a feasibility study with written request from the state or a local government official, and approval of the division office. The first $100,000 of a project study is a federal expense. The cost-share for the rest of the study and the recommended project (if any) is 50-50. Operation and maintenance is 100% non-federal.

The Corps' jurisdiction is limited to drainage areas that are over 1.5 square miles with a 10-year flood discharge of 850 cubic feet per second or more. Crabtree Swamp and the Waccamaw River meet these criteria.

Natural Resources Conservation Service Programs (NRCS)

The Natural Resource Conservation Service's Small Watershed Program and Flood Prevention Program helps local government sponsors solve natural resource and related economic problems, including flooding, on a watershed basis. Either the City of Conway or Horry County could be a sponsor. Watersheds must be 250,000 acres (390 sq. miles) or less. Crabtree Swamp meets the size criteria but the Waccamaw River would not.

Each project must contain benefits related to agriculture, including rural communities, that account for at least 20 percent of the total benefit of the project.

This program provides both technical and financial assistance. The project can have up to a 50% non-federal cost share. The federal share of a project's cost is limited to $5,000,000.

National Park Service

The National Park Service's Rivers Trails and Conservation Assistance program could provide staff assistance to research the potential for an open space corridor along the Crabtree Canal. This federal agency specializes in working cooperatively with local government and community groups to conserve special local resources. They focus heavily on involving the public in the planning process and encouraging projects that support voluntary participation programs.

For more information: Contact Mr. Chris Abbott in Atlanta at 404/562-3175.

[This page intentionally blank.]